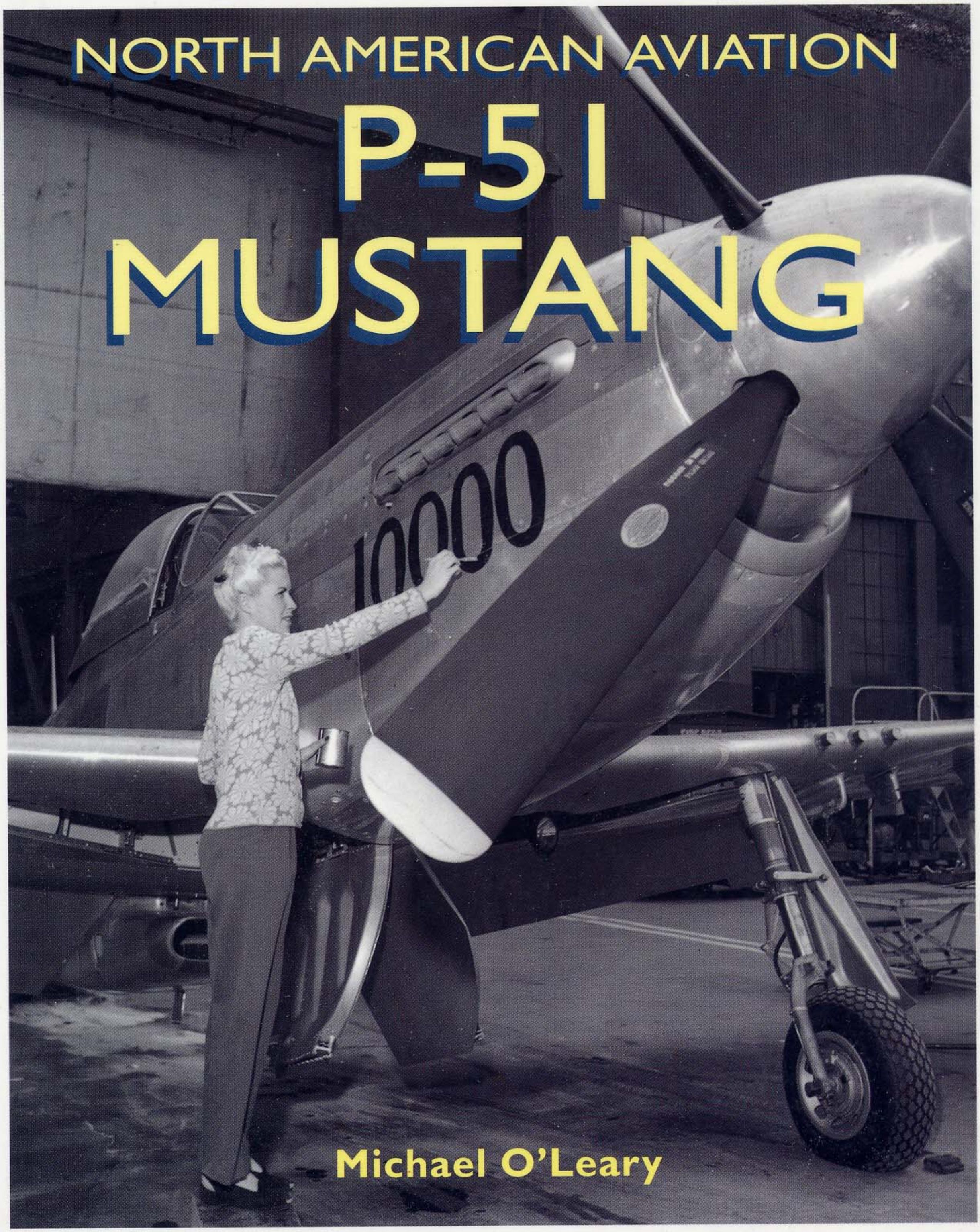
OSPREY AVIATION

PRODUCTION LINE TO FRONTLINE **1**



NORTH AMERICAN AVIATION
P-51 MUSTANG

Michael O'Leary

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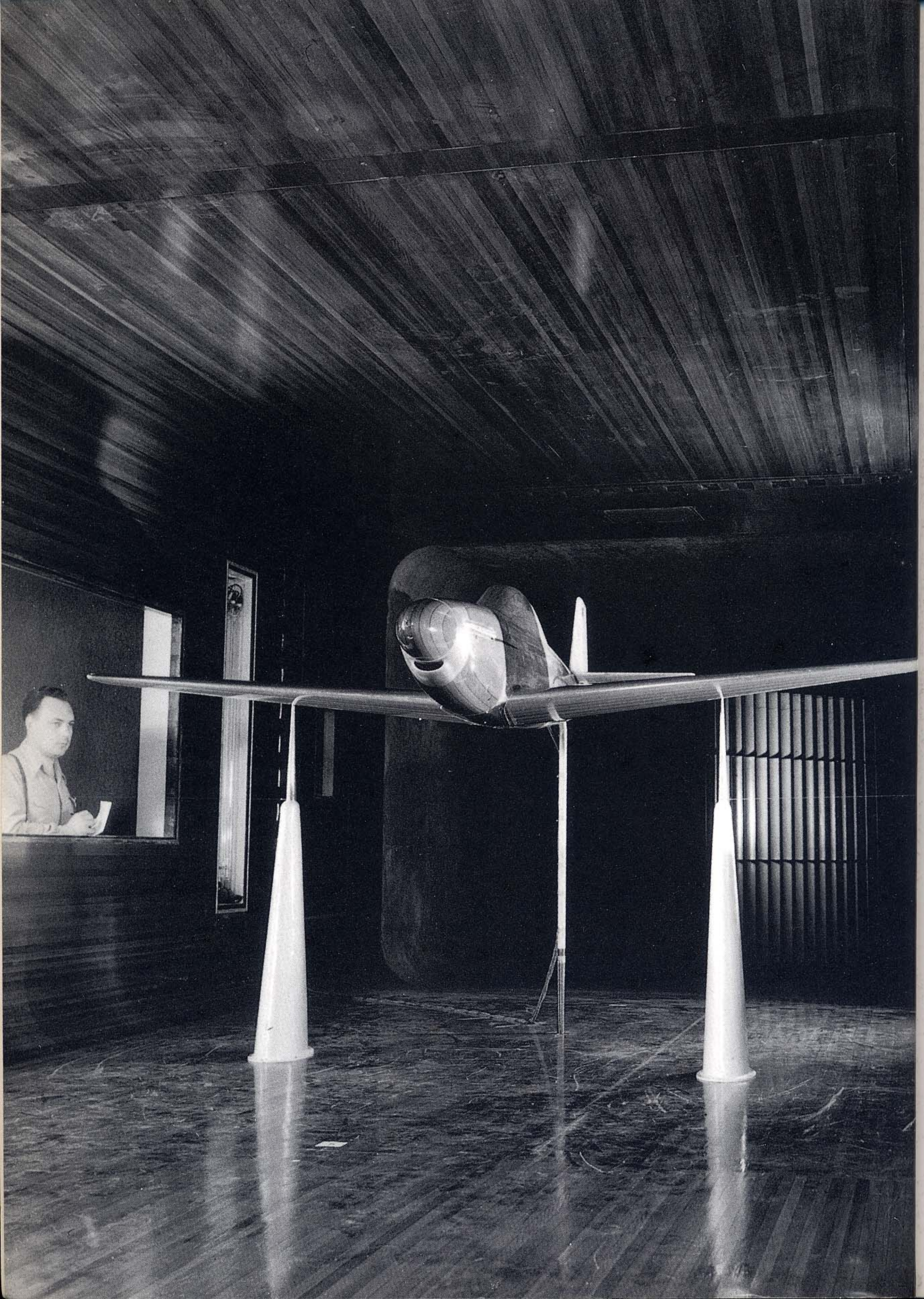
MUSTANG



SERIES EDITOR: TONY HOLMES

PRODUCTION LINE TO FRONTLINE • 1

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P-51 MUSTANG

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AVIATION

FRONT COVER With a minimum of celebration, a worker applies a rather crude number 10,000 to identify the 10,000th Mustang as it rolls off the production line

BACK COVER With cowlings neatly stored aboard the *Wabash Cannon Ball*, a factory-fresh P-51D has its Packard V-1650 fired up for the first time after its attachment to the airframe

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EDITOR'S NOTE
To make this new series as authoritative as possible, the editor would be extremely interested in hearing from any individual who may have relevant photographs, documentation or first-hand experiences relating to the elite pilots, and their aircraft, of the various theatres of war. Any material used will be fully credited to its original source. Please write to Tony Holmes at 10 Prospect Road, Sevenoaks, Kent, TN13 3UA, United Kingdom.

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INTRODUCTION

WELCOME TO THE FIRST VOLUME in an exciting new series from Osprey. *From Production Line to Frontline* was conceived in late 1996 when the author and editor Tony Holmes were going through an extensive collection of North American Aviation P-51 Mustang photography. Arguably one of the more attractive aircraft to come out of World War 2, we were taken by the way the fighter was created to a British specification in a fairly short space of time, and then went on to become a mass-produced combat classic.

There have been numerous books written on the Mustang over the years, but we wanted to approach the aircraft from a rather unique perspective – its production life. America's direct involvement in World War 2 was under four years, yet in that very short time period a lifestyle was created that would effect future generations. The nation made a massive shift from a mainly agricultural economy to an industrial giant during those few years, and the rapidly emerging aviation companies took full advantage of the lessons of Henry Ford to apply mass-production techniques to the building of aircraft.

Los Angeles became one of the world's major centres for the production of combat aircraft, originally starting with desperate orders from the French and British, and then moving into massive contracts from the US Army Air Force and Navy. With excellent weather, cheap land prices and an increasing pool of available workers, aviation companies began huge expansion programmes, while hiring tens of thousands of new workers. For the first time women became a major influence in the work place as thousands of 'Rosie the Riveters' were hired to take the place of men going into the military. Barely recovering from the Great Depression, families were suddenly taking in more money than they had ever seen. Life styles and concepts were changing, and America would never be the same again.

In this volume we follow the saga of the P-51 production through a fairly unique series of photographs. In order to place the product in its intended environment, we also present photographs of the Mustang in combat. We have used the World War 2 period as a cut-off date for this first volume on the P-51, since we wanted to show the aircraft in the global situation for which it was designed – a second volume, featuring the experimental lightweight Mustangs, P-51F/H, P-82 Twin Mustang and postwar F-51Ds is planned for 1999.

I would like to take the opportunity to thank some individuals who helped make this book possible; Gene Boswell of North American Rockwell, who realised the importance of preserving some of the images seen on these pages; Pete Regina, Lowell Ford, Simon Brown, Bruce Lockwood, Alan Preston, David Price and Carl Scholl, who all provided valuable information; and Scott Bloom for the provision of the vintage Mustang advertisements.

We look forward to receiving your comments on this book, and since there are numerous other volumes planned for this series, we would appreciate your input with memories, documents and photographs. Queries to the author should be addressed to Michael O'Leary, PO Box 6490, Woodland Hills, California, 91365, USA.

Michael O'Leary
Los Angeles May 1998

CHAPTER 1

THE PROTOTYPE

BY MID-OCTOBER 1940, North American Aviation (NAA) had become firmly established at Mines Field in southern California – the airfield that is now Los Angeles International Airport. Building their rugged NA-16 series of training aircraft, NAA had decided to move from Maryland to join the many other aviation companies that had established facilities in southern California, and Mines Field was picked because it offered an established airfield that was not only close to supply sources but was also cheap (NAA's 20-acre site was leased to the company for the princely sum of $600 per year!).

The new NAA factory was opened in 1936 and covered 159,000 square feet, while 150 employees became engaged in production of the NA-16 trainer and the portly O-47 observation aircraft. The many problems that plague a new company were conquered by NAA president James H 'Dutch' Kindelberger and his small hard-working staff.

Britain had become interested in the NA-16, which had turned into the AT-6 Texan, and in 1938 began ordering the sturdy advanced trainer for the Royal Air Force (RAF) and other Commonwealth air forces as the Harvard. Because of the rapidly escalating tensions with Hitler's Germany, the European nations were rearming at an unprecedented pace and attempting to buy as much military equipment as possible.

Britain had ordered the Curtiss P-40 Tomahawk and, because of the large orders, was interested in perhaps having NAA build the type under license. The small, but creative, NAA management team decided that it would be much more beneficial to the company to create their own fighter for the RAF. What they wanted to do was take the Allison V-1710 (at the time the most powerful V-12 in production in the USA) and wrap it around a new airframe that would outstrip the P-40 in performance.

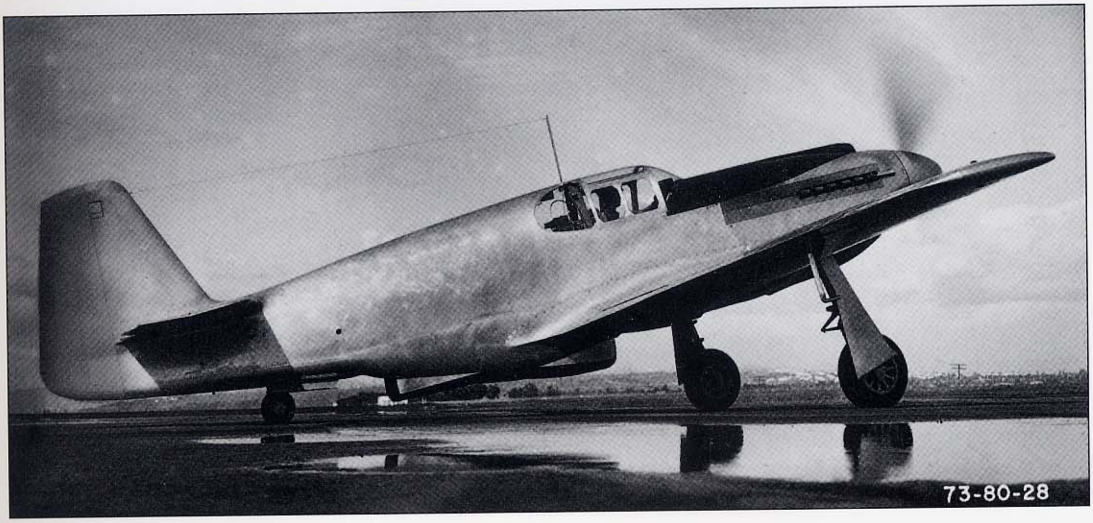
In 1936, NAA hired a new employee – German-born Austrian Edgar Schmued. For a bit of confusing company history, we must go back to the late 1920s when General Motors (GM) created a holding company with the name North American Aviation. This company existed solely to acquire stock in other aviation concerns – giving GM a possible shot at controlling the rapidly emerging aviation market. In 1929, NAA took over the Fokker Aircraft Corporation and Schmued, who worked for GM as a field service manager in Brazil, moved to the USA to work with aircraft – something he had always wanted to do, with his training as a mechanical engineer.

Fokker soon became General Aviation, but the Airmail Act of 1934 forced airmail carriers to rid themselves of holdings that controlled aircraft construction. This meant that GM had to get rid of NAA which, in turn, took over General Aircraft. Kindelberger had come from Douglas Aircraft a year earlier, and was now president of the 'new' NAA. 'Dutch' moved the company west and asked Schmued to join him, but Schmued's wife did not want to move to California so the designer joined the firm of Bellanca – a decision he soon regretted.

However, 'Dutch' had kept the job offer open, and Schmued and his family finally moved west. However, just 100 miles from Los Angeles, the family was involved in a serious car accident which killed Schmued's wife and left the designer seriously injured – it took him until February 1936 to recover.

Once British interest in the new fighter design had become more solidified, the problem of creating a new airframe around the V-1710 was the type of challenge enjoyed by Schmued. The inline V-12 required a large radiator for cooling, and its placement could greatly affect performance – to the positive or negative. At the time, Lee Atwood was 'Dutch's' right-hand man and chief engineer for the company. Atwood, a component designer and mathematical analyst at Douglas, was hired away by 'Dutch' and was responsible for the NA-16. In the 1990s, Atwood would claim he came up with the idea of placing the radiator on the new fighter design *behind* the pilot. However, Atwood's claim was rebuffed by several other surviving NAA employees from the time period, who stated that the location was the obvious choice.

This view of the prototype NA-73X shows both the moveable front scoop and the rear duct in the full down position, thus increasing air flow. Other points of interest include the fact that NAA, for some obscure reason, rather crudely airbrushed the original negative to eliminate the civil registration on the rudder. Also, a black anti-glare panel has been added ahead of the windscreen



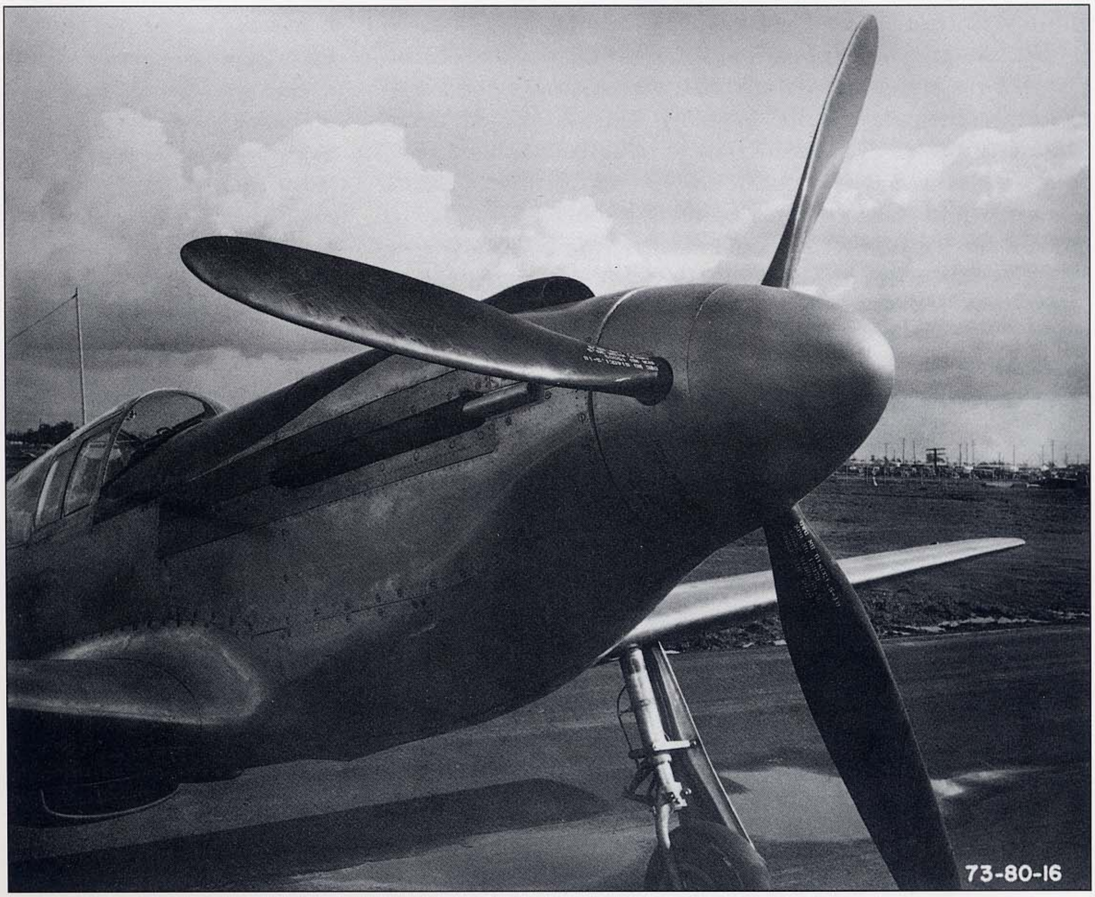
By placing the radiator to the rear, a modest increase in thrust could be achieved by taking in cold air which would rapidly expand and reduce in velocity before travelling through the radiator. This led to an efficient heat exchange which created energy that moved through a narrow duct, exiting through a moveable duct.

Thus, it was estimated that around 90 per cent of the cooling system drag would be eliminated by the efficient thrust of the exiting air.

In his new position at NAA, Schmued worked on various projects including the B-25 bomber and NA-35 primary trainer, but he also kept working on his own personal concept of an 'ideal' fighter. As interest from the British Purchasing Commission increased in having NAA license-build P-40s, a proposal was presented to the 'Brits' on the new fighter. To give an indication of how events progressed during this trying time period, the British liked what they saw in their April 1940 meeting with Atwood and issued an order for 320 examples of the new fighter (see chapter two for contractual details)

'Dutch' placed Schmued in charge of the project, but the British also put in a requirement that NAA purchase wind tunnel data from Curtiss on their XP-46 (an 'improved' version of

This detail view of the NA-73X shows the beautifully streamlined cowling which covered the Allison V-1710 – the former was handbuilt by NAA's metal shop and neatly housed the engine installation designed by Art Chester



Magnificently constructed from different types of wood, a model of the NA-73X is seen in the wind tunnel at the California Institute of Technology in Pasadena

the P-40 design, and one of the ugliest aircraft ever built). Curtiss made a quick $56,000 profit from the sale and Atwood went to Buffalo, New York, to collect the papers and data. In correspondence with Sir Henry Self, Atwood would write on 1 May 1940, 'We have reached an extremely satisfactory agreement with the Curtiss Aeroplane Company of Buffalo whereby they are furnishing to us data covering a comprehensive series of wind tunnel, cooling and performance tests of a similar airplane, which data will assist us in the design and manufacture of these airplanes'. Chief aerodynamicist Ed Horkey examined the data and found it virtually useless. Schmued would later claim he never even saw the Curtiss data.

On 10 April 1940, the British signed the go-ahead letter for the NA-73X project ('73' for the NAA model number, 'X' for experimental), while the formal contract was signed on 23 May. The small NAA engineering department issued drawings to the fabrication shops in a never-ending stream that included 16-hour work days, seven days a week. 'Dutch' and his team were aiming for a delivery date of a complete airframe in January 1941. However, the NA-73X was rolled out of the hangar in 117 days – although incomplete in some details and sitting on tyres and wheels grabbed from the Harvard production line (NAA would record that they had expended 78,000 man hours engineering the prototype). Also, the engine had not been delivered from Allison and it would be another 20 days before the V-12 arrived to be mated to the airframe. The firewall forward powerplant design installation for the aircraft had been entrusted to Art Chester, a well-known race pilot and buddy of 'Dutch's' (and who would go on to figure in other aspects of the type's production history), who did an exceptional job installing the powerplant in a neat package with a closely-fitted cowling.

Allison engineers had rated the V-1710 at 1100 horsepower, but had fixed the critical altitude at 11,000 ft, and here lay the inherent weakness of the engine. This critical altitude figure meant that the performance of the fighter would start to fall off at any altitude over 11,000 ft, thus giving a critical advantage to enemy fighters with a higher altitude rating on their powerplants.

NAA hired freelance test pilot Vance Breese – a colourful and often outspoken personality – to do the first test flight. At the time, several freelance pilots vied for test work, and the pay was often very lucrative. The morning of 26 October 1940 found the NA-73X parked on the ramp with Breese in the cockpit, going over a mental check list. Hitting the starter, the Curtiss-built propeller jerked a few times and the Allison burst into full staccato life, with just a hint of smoke dissipating from the exhaust stacks. The powerplant had been run up by mechanics earlier in the morning.

S-turning, Breese began to taxy the prototype – the long nose obscured forward vision, which made S-turning mandatory. Pointing the nose into the wind and standing on the brakes, Breese gave the Allison a thorough run-up. Once satisfied, the pilot took the active and moved the throttle smartly forward. After rolling a hundred feet, he brought the engine up to full power and pointed the nose down the centre line of the runway, shoving in right rudder to counteract the torque.

The NA-73X was quickly airborne but the first flight was a rather sedate affair, Breese keeping within gliding distance of Mines Field. After flying for about 20 minutes, he found the gleaming that the aircraft exceeded initial performance estimates. Throttling back, he brought the NA-73X in for a smooth landing – three more test flights were made by Breese before he went on to other projects.

NAA was fortunate in having access to an excellent wind tunnel facility at the California Institute of Technology in nearby Pasadena. Conceived in the 1920s by Theodore von Karman (considered by many to be the father of aeronautics), the tunnel was used by NAA to prove many of its design advances. So important was the tunnel to the later war effort that armed guards were positioned around the building in which the tunnel was housed. Cal Tech scientists and engineers worked around-the-clock shifts. Just before the war began, the tunnel was officially inspected by Charles A Lindbergh, who was on special assignment for the government to inspect the nation's aeronautical research capabilities. The wind tunnel was built with a grant from the Daniel Guggenheim Fund, which also made possible the founding of the Guggenheim Aeronautical Laboratory (GALCIT) and an entire academic building in which to house the facility. NAA used this facility throughout the war.

Paul Balfour (commercial pilot certificate number 12596) was hired by NAA and assigned the post of chief test pilot for the NA-73X. Before his death in the early 1970s, Breese made the comment that he had bet money with NAA officials that Balfour would crash the aircraft on his first flight. Breese won.

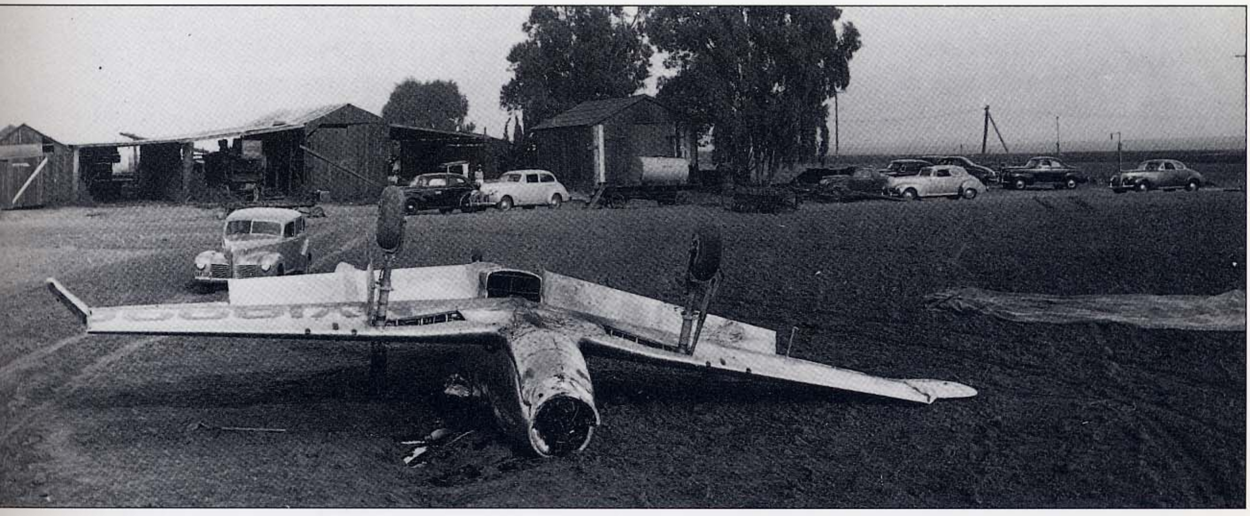
The stricken NA-73X is seen in a bean field just 150 yards west of Mines Field shortly after its crash landing on 20 November 1940. Test pilot Paul Balfour managed to scramble to safety via the canopy's side window. This view shows the aircraft's generous flap area to advantage, along with the opening for the air scoop. It is also interesting to note that the Curtiss propeller is not in sight, having been ripped away from the engine and taking the nose gear case along in the process. Note that the both wing tips have been bent out of shape during the accident – decades later, these same outer wing panels would be removed (since they were not essential structures) for a new generation of Mustang pylon racers

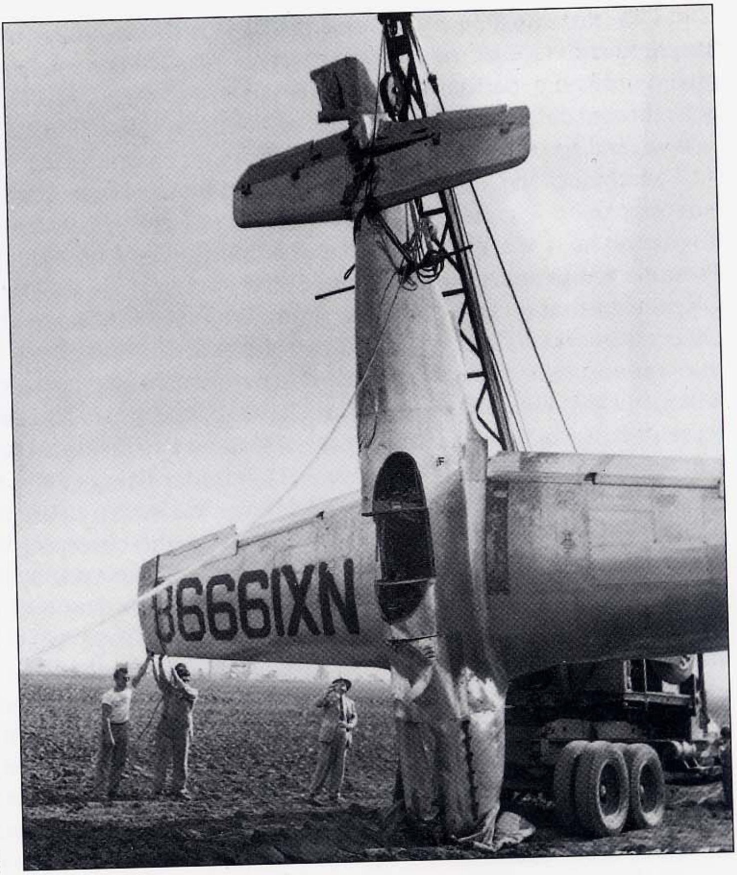
One the morning of 20 November 1941, the groundcrew prepared the NA-73X for Balfour's first flight. With the Allison already running, Balfour climbed into the cockpit and took off at approximately 0710. The purpose of the flight was to undertake several speed runs over timing positions set up on the field.

Mechanic Olaf T Anderson later stated that the engine had run fine on the ground and, 'at about 0540, I warmed the engine up as is the usual procedure before the flight. Oil and Prestone temperatures were normal (oil 65°C, Prestone 95°C). Oil pressure and fuel pressure were normal at 1800 to 2000 rpm. Oil pressure was 80 lb and fuel 13 lb. The engine was run for five minutes and then shut down. When I started the engine for Mr Balfour before take-off, it was a little hard to start (the Allison representative said their engines have a tendency to do such)'.

As Balfour pulled up (after about 12 minutes flying time), the engine stopped completely. Checking the instruments, nothing seemed amiss. However, executing a wide sweeping turn caused the NA-73X to lose altitude and Balfour quickly realised that he was not going to make the runway. During the last portion of the turn, he dumped landing gear and flaps as he directed the stricken prototype toward a ploughed field just west of Lincoln Boulevard. The now-glider whistled down in a correct landing attitude, but as soon as the tyres touched the soft soil (at approximately 0723), the NA-73X violently flipped over. The built-up structure behind the pilot saved Balfour from being crushed, and the pilot scrambled for safety from the moveable side window.

At the time of the accident the prototype had accumulated just three hours and twenty minutes of flying time (Balfour had logged 2298.40 hours of solo time at this point). The Civil Aeronautics Authority Air Safety Board listed damage to the aircraft as 'engine housing broken, both wing tips damaged, tail surfaces damaged, top of fuselage damaged, and other miscellaneous damage'.





The NA-73X is lifted from the bean field by crane. Note the smashed cowling and vertical fin, and how the cockpit area escaped damage, courtesy of the extremely robust roll-over structure behind the pilot

Investigation of the crash revealed that the Allison had run dry when the selected tank had been allowed to be run out of fuel. North American and the British both agreed that, in spite of the crash, they had a winning aircraft and the accident was no way the fault of the design.

Some aviation historians have recorded that the prototype was scrapped after the accident but this was not the case. Actually, the prototype was carefully lifted out of the bean field by crane and transported back to the NAA factory, where it was stripped apart and rebuilt in a very short time.

R C 'Bob' Chilton was hired as chief test pilot to replace the unfortunate Balfour, and a study of his log books indicates that he flew the rebuilt NA-73X on 3 April 1941 for a one-hour familiarisation flight from Mines Field. Chilton also recalled that the NA-73X had made between five to six flights with another pilot at the controls immediately after its rebuild. Chilton went on to make at least a dozen more flights with the aircraft.

He later remarked, 'the NA-73X was a clean flying aircraft with no bad vices. It was quite pleasant in the air and handled very similar to the later production articles'.

Chilton had accrued considerable fighter experience in the Army Air Corps before coming to NAA, flying the Boeing P-12 and P-26, Curtiss P-36 and other fighter types. His expertise in the fighter field enabled the engineers to incorporate changes that would be beneficial to the combat pilot.

'I recall that the NA-73X was just pushed to the side after it had been retired from its last flight', stated Chilton. 'It probably ended up on the company's junk pile, but I do not recall seeing it there. The NA-73X was a very attractive machine and its aluminum skin glowed with constant waxing by George Mountain Bear Lane, an American Indian whose duty was to keep the airframe as clean as possible to pick up those few vital miles per hour.'

With the first aircraft coming off the production line, NAA and the British decided to use these airframes for continued testing. 'The "old" NA-73X was no longer representative of the design', stated Chilton. 'We had orders on our hands for hundreds of new fighters and the NA-73X had served its purpose. It had established the trend for what I believe was the finest propeller-driven fighter ever built by any country.'

Recent research indicates that the NA-73X, stripped of useable components, *may* have been donated to a local trade school.

Following the arrival of this official British Purchasing Commission communique at NAA on 12 December 1940, the NA-73 became known as the Mustang

EXPORT OFFICE BRITISH PURCHASING COMMISSION
DECEMBER 9, 1940

IN REPLY PLEASE QUOTE BAC/C/A250 (FSC)

NORTH AMERICAN AVIATION, INC., INGLEWOOD, CALIFORNIA

CONTRACT A250
FOR THE SUPPLY OF NA-73 AIRPLANES AND SPARES
LETTER OF AMENDMENT NO 13

GENTLEMEN:

WE ARE TO INFORM YOU THAT THE ABOVE MENTIONED AEROPLANES HAVE BEEN GIVEN THE OFFICIAL DESIGNATION 'MUSTANG', AND THIS NAME SHALL BE USED IN ALL CORRESPONDENCE..

PLEASE RETURN TO US THE THREE ATTACHED COPIES OF THIS LETTER DULY SIGNED BY AN AUTHORISED OFFICER OF YOUR COMPANY.

VERY TRULY YOURS,
HIS MAJESTY'S GOVERNMENT IN THE UNITED KINGDOM BY BRITISH PURCHASING COMMISSION

BY (SIGNED) R. F. PAYNE
FOR AND ON BEHALF OF THE DIRECTOR GENERAL

ACCEPTED: DATE DEC. 12, 1940
SUPPLIER: NORTH AMERICAN AVIATION, INC.
BY: (SIGNED) NOBLE SHROPSHIRE
TITLE: CONTRACT ADMINISTRATOR

LAMINAR FLOW

One of the main factors in making the P-51 a high-performance fighter was the development and production of a wing incorporating a laminar airfoil. The concept was originally developed by the National Advisory Committee for Aeronautics' A C Robinson, who did a paper on the subject, and later supplied data and research notes on laminar airfoils. Although the laminar concept had been known for quite some time, it had rarely been applied to an actual aircraft.

Basically, a laminar flow featured a symmetrical air foil that utilised the same curvature on lower and upper surfaces. The leading edge was kept as thin as possible while the airfoil's greatest thickness was placed as far back as possible. In practice, this would keep the boundary layer air flow adhering to the wing surface further aft of the leading edge than any other type of airfoil. Employing a normal airfoil would mean that the boundary layer broke up much earlier on the wing surface, causing turbulence resulting in drag, and a drop performance.

Unfortunately, the few wings that had been constructed to take advantage of the laminar principle where hand-built, and the surfaces had been highly finished to promote a true laminar flow. Such hand-finishing would be impractical on a production-line fighter, so NAA engineers came up with a method of filling and sanding the leading edge of the wing to insure laminar flow – 'laminating' layers of air over and under the wing to insure a perfect and smooth air flow.

With such a radical airfoil, and a new method of production, NAA made sure that they had an 'escape route' should the laminar flow wing not work, designing a more conventional flying surface that could quickly be put into production should the former unit prove to be a failure. Fortunately, the laminar flow experiment (tested in the wind tunnel at the California Institute of Technology in Pasadena) proved workable in mass production, and the final airfoil had a thickness ratio of 15.1 per cent at the wing root at 39 per cent of the chord. Tip ratio was 11.4 per cent at the 50 per cent chord line, with the maximum thickness area at 40 per cent from the wing's leading edge. This resulted in a small negative pressure gradient over the first 50 to 60 per cent of the wing.

At the factory, the wings were primered and finished with airfoil smoother. The first 40 per cent of the wing chord was shot with one coat of zinc chromate primer. This was then followed by enough coats of Acme Gray Surfacer No 53N5 to cover all irregularities. Skin butt joints were then filled with Acme Red Vellunite glazing putty No 58485. The entire area was then sanded down and sprayed with one coat of camouflage enamel (when camouflage was deleted, the forward portion of the wing was sprayed silver). This was a simple and quick way to create a nearly perfect laminar flow surface, but one has to wonder just what effect all those size 12 GI boots (worn by both air- and groundcrew) in the field had on the carefully-applied laminar flow finish!

CHAPTER 2

BUNDLES FOR BRITAIN

AS MENTIONED IN THE previous chapter, the British Purchasing Commission was extremely pleased with the aircraft created by North American's design team, but their initial order received a codicil from the US government. In return for letting Britain order the new fighter, it wanted two early production aircraft made available to the United States Army Air Corps at absolutely no cost. The British enjoyed putting names to their aircraft designs (as evidenced by the Spitfire, Hurricane and Blenheim) and, for a while, the name 'Apache' was considered since it represented the wildness of the American west. However, 'Mustang' was finally chosen for the fighter, calling to mind the small, hardy and swift horse of the American plains that had descended from Spanish stock. It would turn out to be a particularly appropriate name.

In light of the British (and American) interest in the new fighter, it was just as well that NAA had established an efficient production line prior to unveiling the NA-73 – a fact that has been mainly overlooked when analysing the success of the design. Besides cranking out a few O-47 observation aircraft, the company's main manufacturing thrust had been with the BT-9/Texan/Harvard series of trainers. Copying the same efficient style of trainer production, a line was set up in rapidly constructed new buildings at Mines Field which would easily accommodate the flow of sub-assemblies that were eventually turned into complete fighters.

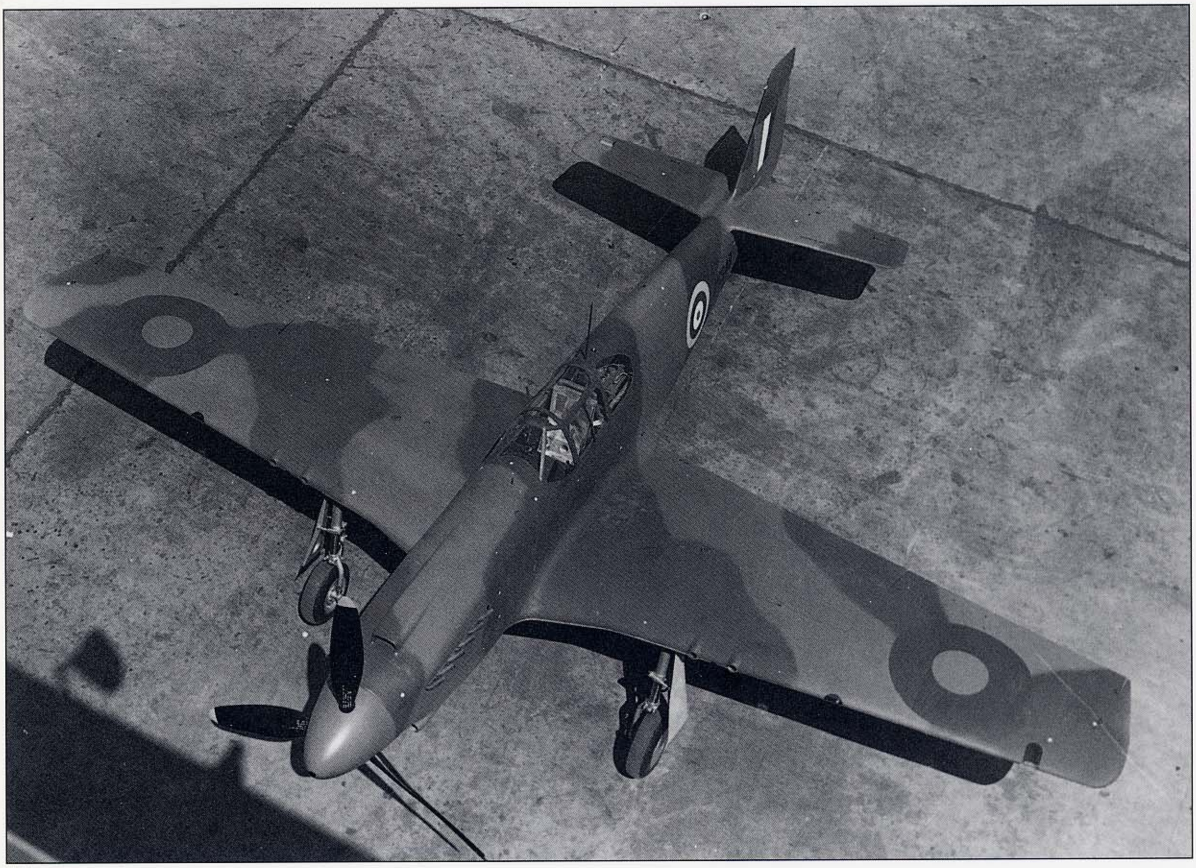
In comparison, the Supermarine Spitfire was a very complex fighter to build, and was not really suited for the style of mass-production techniques envisioned by Henry Ford – the creator of really efficient mass-production. Unlike the Spitfire, the Mustang 'went together' almost like a large metal model aircraft kit, making it ideally suited for construction in very large numbers. 'Dutch' Kindelberger kept pressuring for an advanced production line, apparently realising that the coming war, and the Army's growing interest, would lead to many more orders.

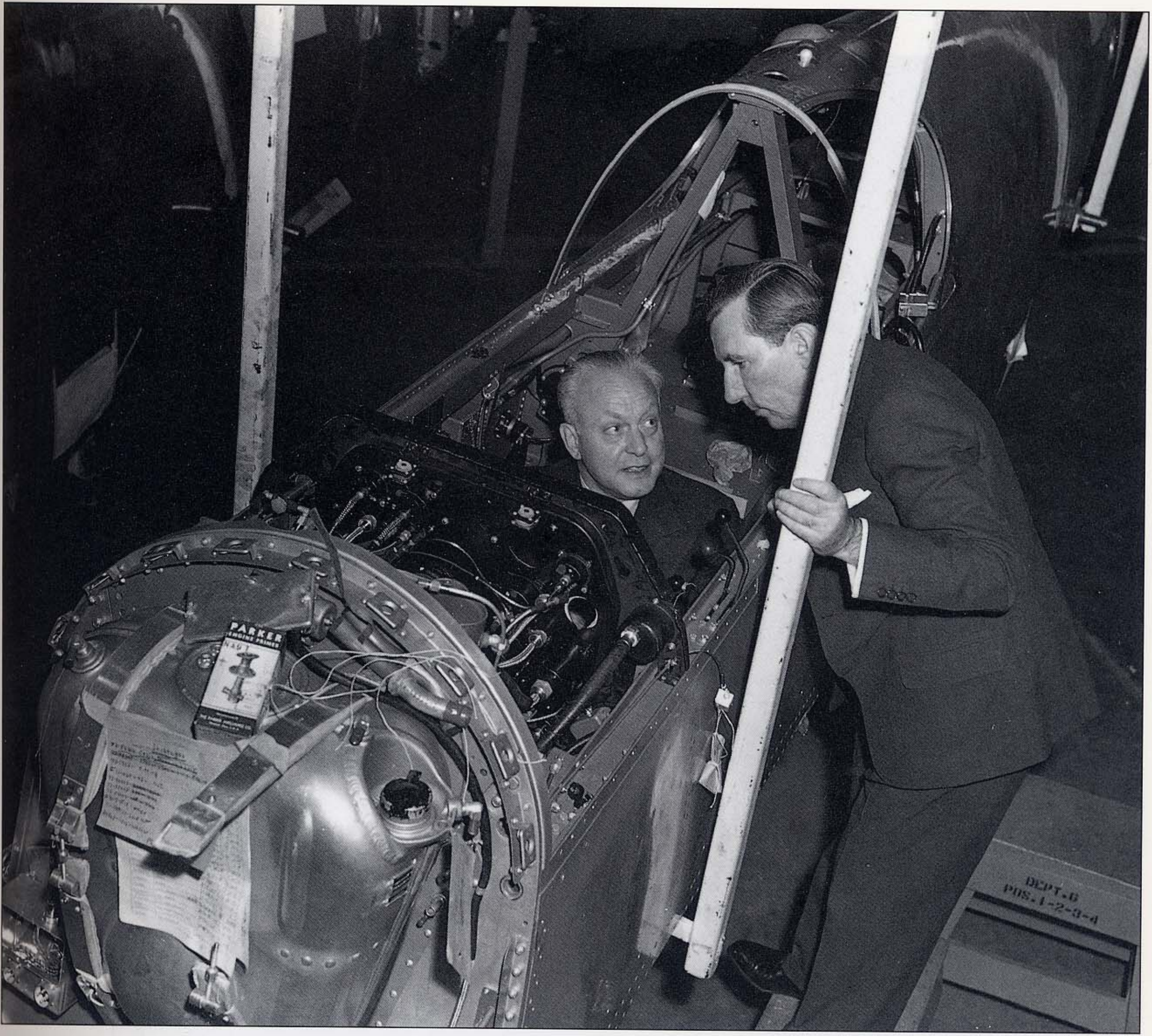
The year 1941 was an extremely busy one for NAA. Position vacant ads in southern California newspapers brought in hordes of workers from all across the nation – men looking for steady work to escape the effects of the Great Depression.

NAA was hiring by the hundreds as the initial order for the Mustang Mk I amounted to 320 aircraft (rapidly growing to 620 aircraft), and skilled workers were at a premium. Typical for the time period, the price of the aircraft would exclude the engine, armament, radios etc. The RAF was getting the basic airframe, and although everything else would be added on at the NAA factory, the British government was responsible for purchasing and supplying the remaining items. As a contract stipulation, the basic airframe price was not to exceed $40,000.

The premier Mustang Mk I (RAF serial AG345) made its first flight from Mines Field, with Louis Wait at the controls, on 23 April 1941. The second aircraft – AG346 – was disassembled and fitted in a stout wooden crate for the hazardous ocean voyage, arriving safely at Liverpool on 24 October 1941. The Mustang was taken to Speke Aerodrome for initial flight testing, which confirmed the results recorded with the NA-73X and AG345. Many British pilots were assigned to fly AG346, and they found the new fighter satisfactory in its designed role.

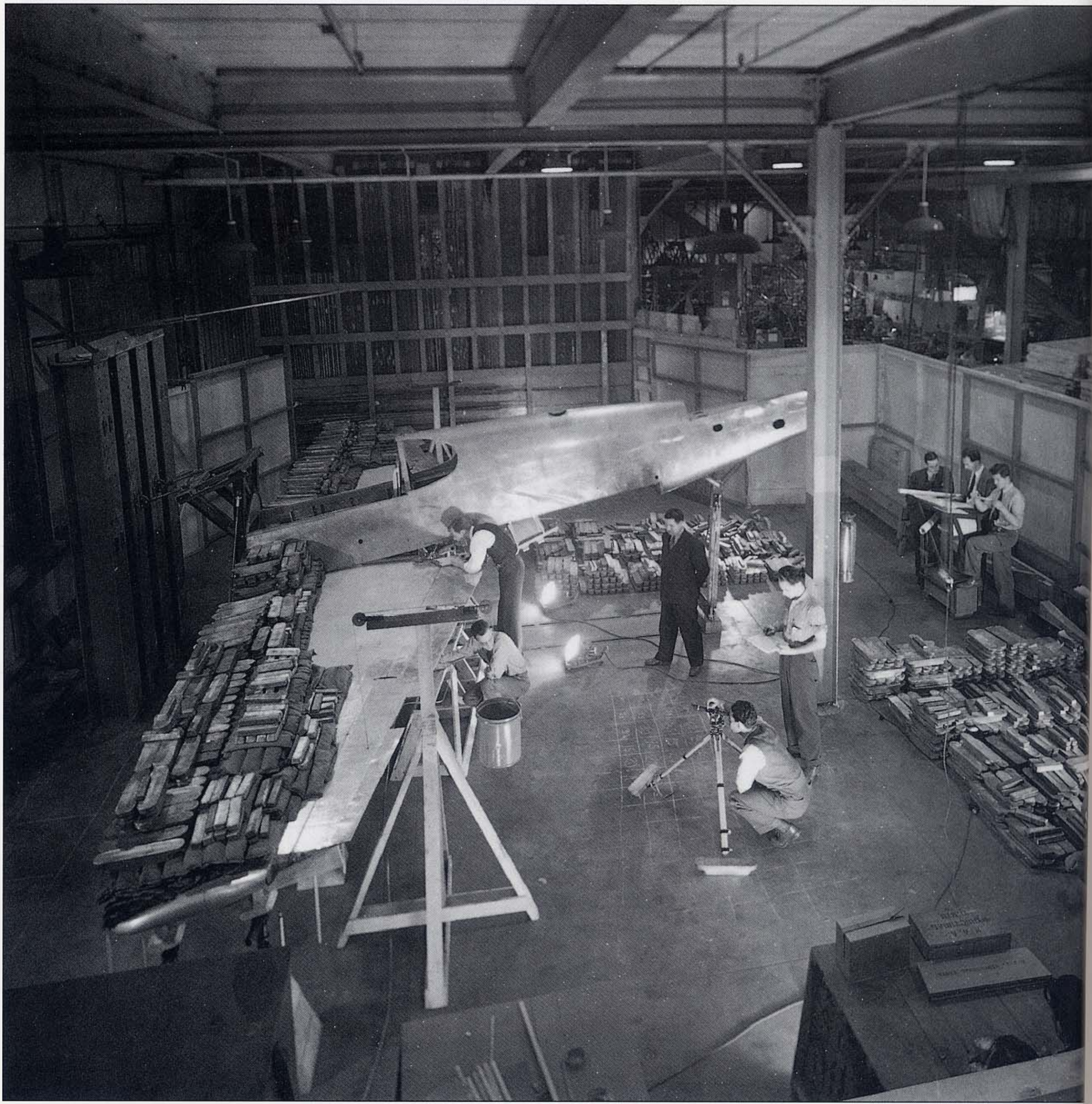
As recorded in the previous chapter, part of the Mustang's excellent performance was due to the clever design of the cooling system, although the major contributor was the aircraft's laminar flow wing. Briefly explained, this is a type of airflow over an airfoil in which the air passes over the surface in





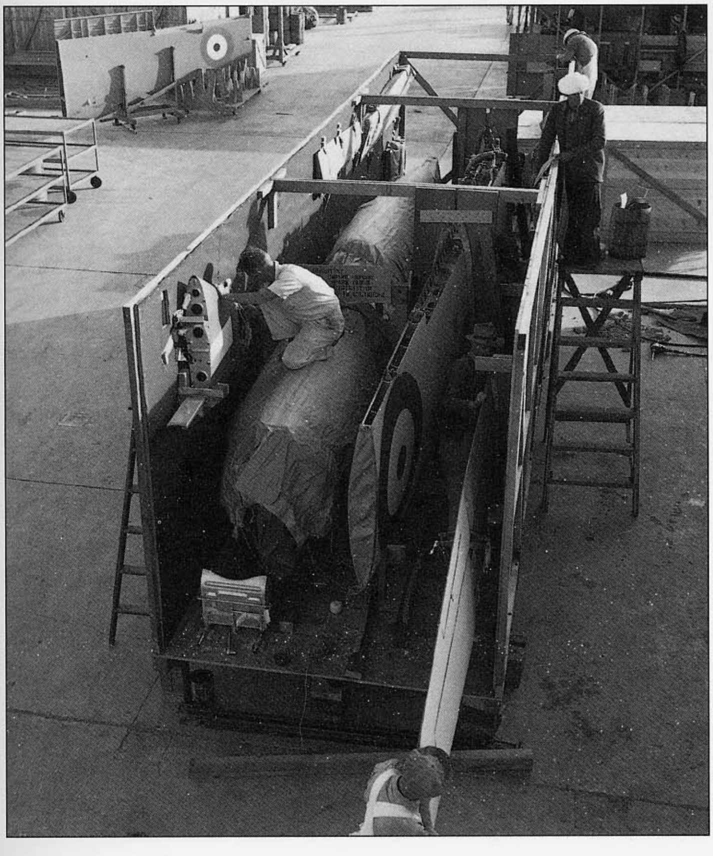
LEFT This wonderful high-angle view of Mustang Mk I AG348 (the fourth production aircraft) illustrates the very simple layout of the fighter, and also shows the angular wingtips to advantage. Most fighters produced previous to the Mustang had elongated curved wingtips which were believed, incorrectly, to cut down on drag. Also, the angular wingtips were much easier in build in mass quantity. The photograph also shows the early short air scoop for the Allison's carburettor. This arrangement caused, at different air speeds and angles of attack, a non-uniform flow of air to the engine which resulted in surging. This problem was solved by slightly raising the inlet and extending the lip closer to the propeller. These early Mustangs were camouflaged in Earth and Green upper surfaces and Sky Type S undersides. Upper wing roundels were red and blue while those on the fuselage sides were, from outside in, yellow, blue, white and red. Finally, the underwing roundels were blue, white and red

ABOVE 'Dutch' Kindelberger is seen in the cockpit (minus the comfort of a seat) of a Mustang Mk I whilst showing the aircraft off to a visiting British official. As can be seen, the fuselage was in a movable jig, and various parts were affixed to the airframe (like the box containing the Parker engine primer on the firewall) along with a list of shortages for the particular airframe

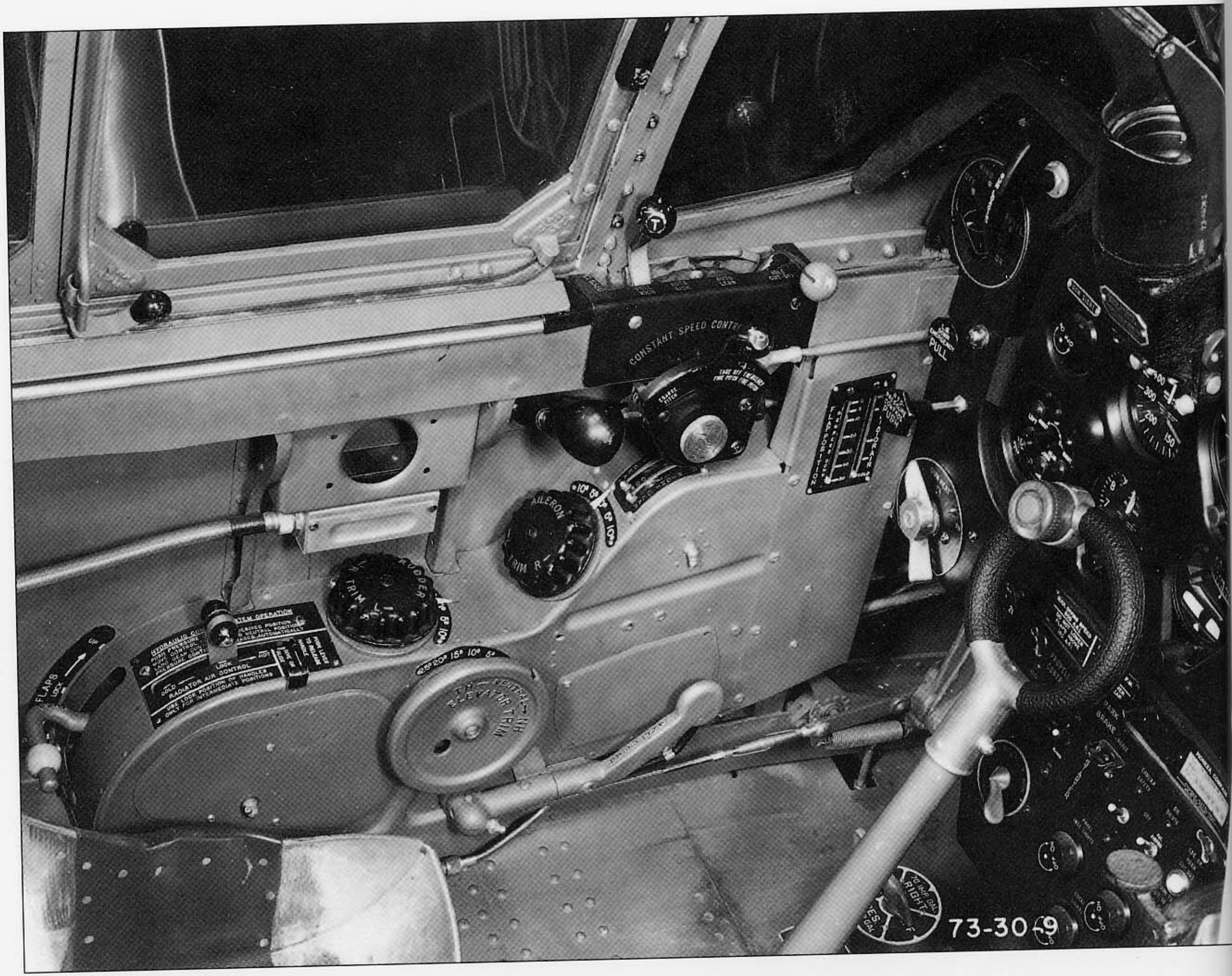


Although it looks a bit crude by today's standards, this airframe is being thoroughly studied as more and more lead weights are added to the aircraft to test its ultimate structural integrity. A temporary wooden partition encloses the aircraft from rest of the factory as such testing could be hazardous since there was always the chance of a catastrophic structural failure, which could send bits of metal flying about at high velocity. Several other Mustang books have wrongly identified this aircraft as the NA-73X. It was an incomplete airframe (often referred to in testing documents as XX-73) that was tested to destruction to provide accurate data on the airframe's strength and then scrapped after the trials had been completed. The testing progressed in a very logical manner, finally culminating with crucial wing strength trials – the flying surface failed at 105 per cent of its design load. This highly-detailed photograph was taken on 16 January 1941

A smiling 'Dutch' Kindelberger and a somewhat dour Sir Hugh Dowding at the NAA plant on 10 February 1941. Dowding, on an inspection tour, is holding a presentation model of the Mustang Mk I



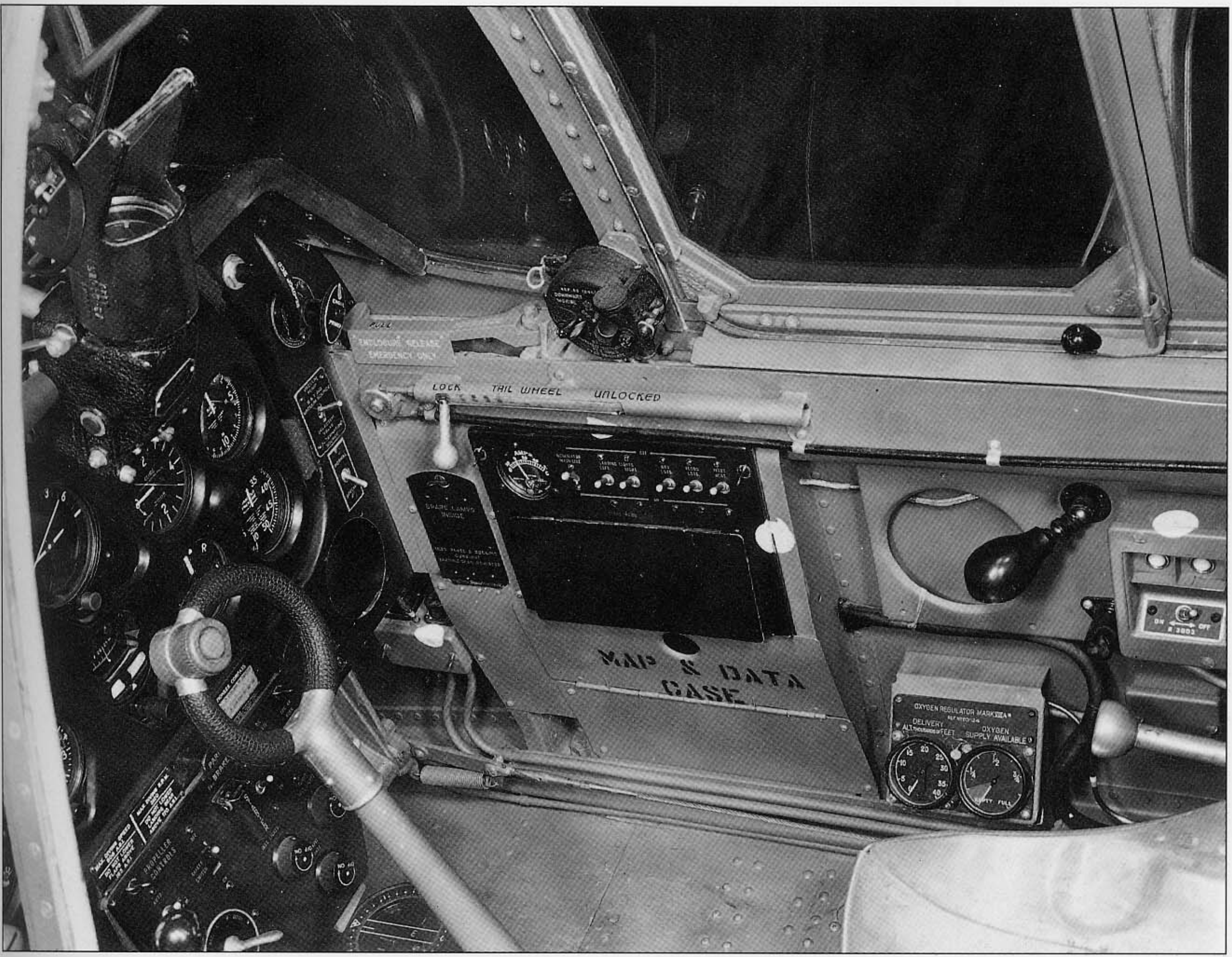
Demand for the Mustang Mk I was so great that early examples were rapidly crated and shipped to Britain. As this photograph shows, the packing crate itself was a bit of a work of art, being designed to hold all of the aircraft's components. While one workman affixes the vertical fin to the right side of the crate wall, another slides in the horizontal stabiliser. Note the pilot's seat fixed to the floor of the crate. The wings in the background are for a Harvard



Left side of a Mustang Mk I's cockpit, illustrating the trim controls for the ailerons, rudder and elevator. The landing gear handle is at the bottom of the side console, while the compact throttle and propeller controls are conveniently placed for the pilot's left hand

smooth layers with a minimum of turbulence. With most airfoils there is a layer of air adjacent to the surface that flows in a random fashion, sometimes even reversing its direction of flow. This is the boundary layer. The laminar flow airfoil is designed in such a way that the boundary layer has a minimum thickness, and nearly all the air flows in smooth layers. Laminar flow of the air decreases the drag produced by the airfoil.

The laminar flow wing on the Mustang was the first time that such an airfoil had been employed on a production military aircraft, the design of the airfoil itself being based upon Russell Robinson's reports filed with the National Advisory Committee for Aeronautics (NACA). Robinson (an aerodynamicist with NACA) had conducted successful wind tunnel experiments with this new generation of low drag airfoils, and NAA aerodynamicist Ed Horkey and his crew laboured for weeks to adopt this data to the new fighter design. Since time was a factor to be reckoned with, Kindelberger issued an order to Edgar Schmued that his team must be ready to design a conventional wing within 30 days in case the laminar flow concept did not

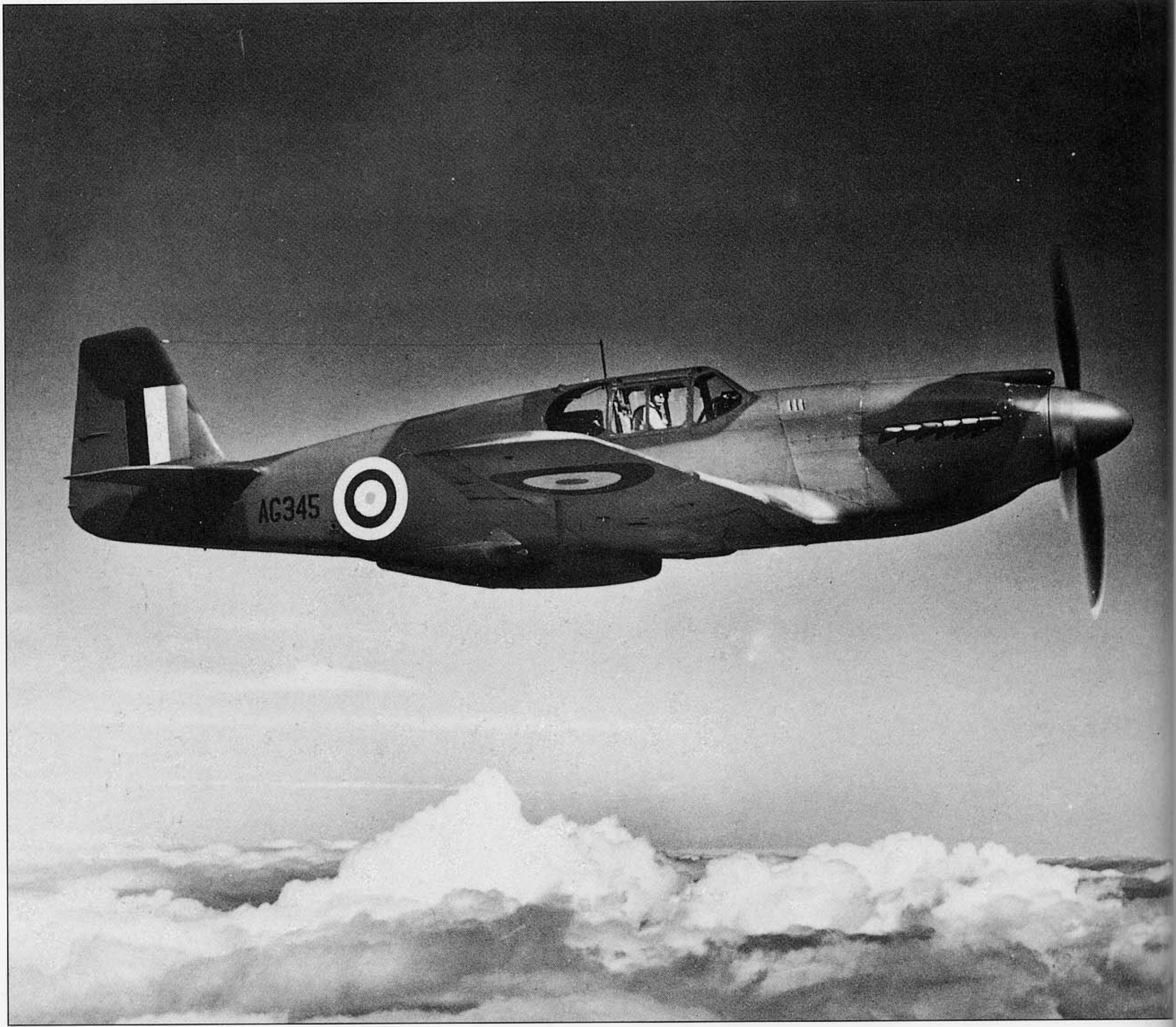


work out (in fact all the data for this 'second' wing was unearthed in 1997 during research in the Caltech files).

Ed Horkey tested his preliminary wing in the wind tunnel at the California Institute of Technology but found that the unit had an unpleasant stall characteristic that was not acceptable to Horkey and would certainly be frowned upon by the British. When a modified wing section only slightly improved the problem, Horkey suspected that part of the problem lay in the tight confines of the Caltech tunnel, so he shipped the wooden wing section to the somewhat larger tunnel at the University of Washington via a United Airlines DC-3. Horkey's gamble paid off, and the wing performed as planned in the larger tunnel.

The Mustang Mk I, designated NA-73, was fitted with four .50 cal and four .30 cal machine guns. Most American fighters were still well behind their European counterparts in the firepower department, and this armament selection was considered quite powerful. Power came from the Allison F3R which reached its optimum power at lower altitudes. Several small modifications were made on combat-ready Mustangs by the

Right side of the Mustang Mk I's cockpit, showing the map and data case, map reading lamp, oxygen regulator and panel for navigation lights, landing light and pitot heat. The round device mounted on the canopy structure is the Morse code key. The spade type grip favoured by the British is also shown to advantage, with the firing button to the left. Cockpit placards warn not to exceed 505 mph in a dive and not to lower flaps at speeds above 170 mph



British, including slight changes to the air duct system and radiator air scoop. During subsequent flight trials, a combat-ready Mustang Mk I was found to be 35 mph faster below 15,000 ft (375 mph) than the standard Spitfire Mk V, although at ceilings above this height performance rapidly fell away due to the design limitations of the Allison which, lacking an efficient form of supercharging, was strictly a low to medium altitude engine – unfortunately the air battles over the Continent were being fought at higher altitudes.

As more early model Mustangs arrived in Britain aircraft were assigned to RAF Duxford for air combat testing, where the type compared favourably with the Spitfire at lower altitudes. Few vices were unearthed, and British pilots were impressed with the NAA's creation of a logical cockpit layout within the confined space offered by the streamlined fuselage. Also while at Duxford, the Mustang Mk I was tested against a captured Messerschmitt Bf 109E and, once again, had a distinct edge over

Fine study of Mustang Mk I AG345 in flight on 19 August 1941 with test pilot Bob Chilton at the controls. The slimness of the radiator scoop installation is noteworthy. This aircraft was retained for a time at NAA to test various improvements – as can be seen, the fighter has been fitted with the raised and extended carburettor air scoop. The first group of Mk Is (serialled AG345 through AG664) were built and delivered to Britain between November 1941 and May 1942. AG345 was struck off charge on 3 December 1946 the Luftwaffe fighter, but it must be noted that the *Emil* was by that time no longer in production, having been replaced by newer and more deadly aircraft.

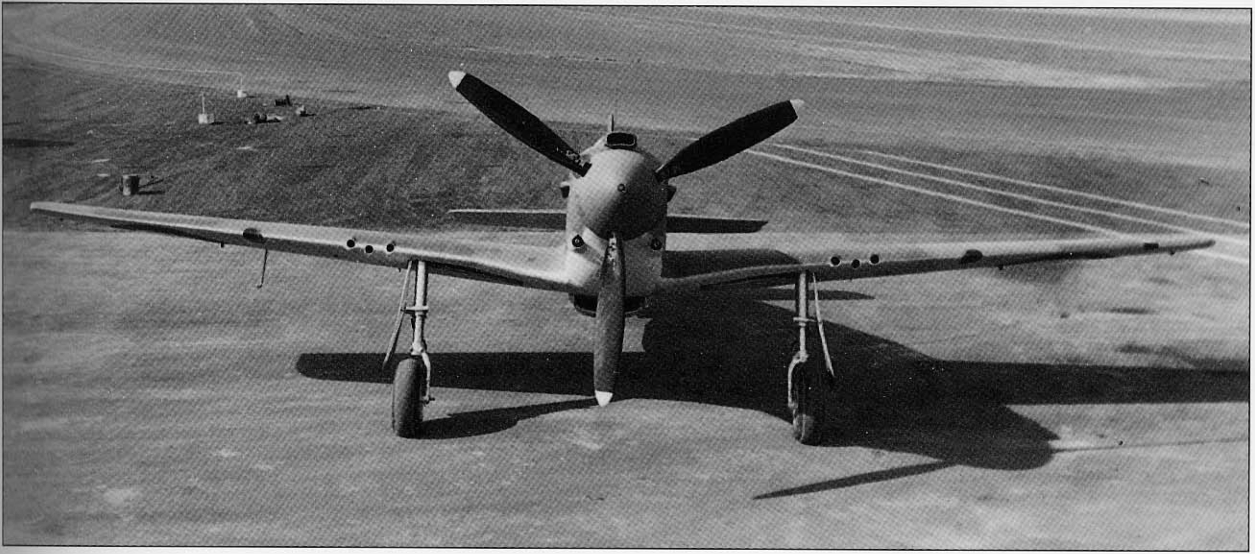
In view of the type's restriction to lower altitudes, the British decided to continue to use the Spitfire as their standard high-performance fighter. RAF Fighter Command rejected the Mustang Mk I, and the aircraft was sent off to the new Army Co-operation Command (ACC). The ACC was established during 1940 to co-ordinate air/ground activities with the Army – a vital task that was neglected, with disastrous results, by the British Expeditionary Force in France.

The Mustang Mk I was ideal for the ACC since it was heavily armed, highly manoeuvrable, had a very good range and could really get moving at altitudes below 10,000 ft – the regime which would be most beneficial to the Army. Up until the introduction of the Mustang, the ACC had been equipped with Westland Lysanders and Curtiss Tomahawks, neither of which were ideal for frontline operations over heavily-defended targets in Occupied Europe. It was initially planned to equip 18 squadrons with the Mustang, but only 16 squadrons were eventually so constituted.

With 'Dutch's' concept of a high-tech production line having been in place from the early stages of the Mustang's development, aircraft were rapidly rolling out of the assembly hangars to join Texans and new B-25 Mitchells on the company ramp. Further modifications were in store for the fighter, however, and 150 Mustang Mk IAs (NA-91) fitted with four 20 mm cannon in the wings were built. Fifty Mk IIs (NA-99) were also supplied to Britain, these being USAAC P-51As pulled from the production line. The RAF eventually received a total of 691 Allison-powered

Mustangs from their original contracts, this figure deleting those aircraft lost at sea during shipping.

BELOW This head-on view of Mustang Mk I AG346 emphasises the aircraft's elegant and slim lines. The position of the armament is also displayed to advantage. Two of the .50 cal weapons were fitted in the lower nose cowl and the remaining two .50s on the inboard wing position, leaving four .30 cal weapons to be housed outboard. The lack of visibility for the pilot in this three-point position should also be noted. This particular aircraft enjoyed a long operational career before being finally being shot down by flak near Gace on 20 August 1944 while serving with No 168 Sqn of the Second Tactical Air Force



DOLLARS AND CENTS

What did it cost for the first Mustangs, what did the British and NAA expect from each other and how was the contract awarded? The following is a letter from NAA's Lee Atwood to Sir Henry Self of the Anglo-French Purchasing Commission. The letter was dated 1 May 1940. In today's litigious society, the letter appears to almost be a gentlemen's agreement;

'In accordance with our understanding, we are proceeding with the design of a single-seat fighter airplane, our Model NA-73, incorporating an Allison engine and fitted with provisions for equipment and armament as detailed more completely hereunder.

'We have reached an extremely satisfactory agreement with the Curtiss Aeroplane Company of Buffalo wherein they are furnishing to us data covering a comprehensive series of wind tunnel, cooling, and performance tests of a similar airplane, which data will assist us in the design and manufacture of these airplanes. We have also received release from the United States Army for the manufacture and export of these airplanes and wish to assure you that all arrangements are entirely satisfactory.

'We are prepared to construct and deliver to you 320 of these airplanes before 30 September 1941, and guarantee to effect deliveries in accordance with the following delivery schedule:

	1941										
	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV
Airplanes	1	5	20	40	50	50	53	51	50	-	-
Spares (equivalent a/c)	1	3	5	5	5	5	10	15	15	-	-

'We further offer to continue the manufacture of these planes at the rate of 50 airplanes per month until at least the end of the year 1941, should you desire to incorporate and exercise an option for these additional airplanes prior to 30 April 1941.

'We have constructed a mockup and have completed the initial phase of the detail design and are submitting to you herewith certain data and information regarding the characteristics of the airplane. You will note that we have provided for armor protection for the pilot and a sealing arrangement for the fuel tanks. Provisions are being made for the installation for four .50 caliber machine guns, two of which are in the fuselage and the other two in the wing. As a normal load we are specifying 200 rounds of ammunition per .50 caliber gun, but are making additional provisions for more ammunition as a special load. Provisions are being made for four British Type 303 machine guns with ammunition boxes to accommodate 500 rounds of ammunition per gun as normal load.

'Strictly for comparative purposes, we are including the results of a study showing the difference in size and performance between the airplane offered and one which might be offered with a minimum armament and without protective armor, but is otherwise the same. It will be noted that the high speed in this condition is 400 mph with a wing area of 190 sq ft. With a full complement of armament and armor plate protection front and rear, the weight is increased from 6450 lb to 7765 lb and the wing area is increased from

190 sq ft to 230 sq ft in order to maintain the same landing speed. The resulting performance is materially reduced and high speed is 384 mph under the same conditions.

'The speeds quoted above are based on a power of 1030 hp at 16,000 ft altitude, using 90 octane fuel. Since we do not have precise and final information on the power rating of the engines to be furnished for these airplanes, this rating is still somewhat of an estimate. We believe the Anglo-French Commission has, or will shortly have, accurate information on this matter. When we receive the exact figures, the performance guarantees will be arithmetically adjusted accordingly.

'The general provisions for armament have been discussed with Air Commodore Baker and Mr. Thomas and it is believed that the arrangement offered is the most practical possible at this time, consistent with the general instructions we have received. It is possible to increase the fire power through the installation of additional guns if absolutely necessary, but the performance will suffer a proportionate loss. We feel there will be no difficulty in making any changes or modifications which you may feel are essential or desirable, and are prepared to co-operate with your technical staff to the fullest extent. We do feel, however, that the design as presented is close to an optimum condition, all things considered. Details of equipment and installation are yet to be covered, but our previous experience with Harvard aircraft, which incorporate much British equipment, leads us to believe that we will have no difficulty whatever in arriving at satisfactory agreements in all these matters.

'We have made a careful estimate of the price, including sufficient structural tests to guarantee the structural integrity of all parts, wind tunnel testing and flight testing. We have included a price breakdown, separating and pricing all items of equipment to be installed and supposedly furnished by us. We have not considered the price of engine, propeller, radio, oxygen, machine guns or other items of armament or military equipment, and it is assumed that these items will be furnished to us free of charge for installation in the airplanes. The price summary for airplanes, exclusive of crating or transportation, but covering all other charges is as follows:

	$
A) Powerplant, engine accessories	983.95
B) Instruments	1787.35
C) Electrical Equipment	890.75
D) Miscellaneous Equipment	528.40
E) Radio Equipment	Customer furnished
F) Armament	Customer furnished
Total equipment to be furnished by Contractor	4190.45
Base airplane	33,400.00
Total per Airplane	37,590.45
Total for 320 Airplanes	12,028,944.00
Spare parts (20%)	2,405,788.80
Crating per airplane $675, total	216,000.00
Crating for spare parts (4%)	96,231.35
Total Contract Amount	14,746,964.35

'Within 60 days after the contract has been executed we will furnish a complete percentage breakdown and a recommended list of spare parts to approximate 20% of the contract prices of the airplanes. Spares will be delivered in accordance with the delivery schedule attached hereto, provided a spare parts list is approved and agreed upon within 60 days after submission of such a proposed list by us.

'We are prepared to proceed immediately upon receipt of a letter from you accepting this proposal and receipt of down-payment. We desire a down-payment of 10% of the contract amount upon approval of this proposal and a subsequent monthly payment of 2.5% of the contract amount each month until 25% of the contract has been paid. Details of final payments and acceptance will be as mutually agreed upon and in general accordance with our previous contracts with the British Government. We feel there will be no difficulty in the preparation of the final contract at your convenience inasmuch as we have reached agreements with your staff concerning all principal points involved in a contract of this type.

'The prices quoted above are intended to include all normal and reasonable modifications and changes which you may require, provided that such changes are agreed upon within three months of the date of the agreement and provided there is no considerable additional expense to us as might be involved in the purchase of additional material or equipment. Changes initiated after this time may involve a delay in delivery or a cost increase.

'May we request that you give this matter your early attention as we are prepared to proceed on receipt of a letter of approval from you and receipt of down-payment as requested above. We will consider the date of receipt of this payment as the date of the contract.

'If there are any matters not properly covered in this letter or the enclosed data and it is necessary to withhold the letter until such matters are clarified, we will greatly appreciate it if you will notify us of these matters by telegram or telephone at our expense in order that there will be no delay.'

OPPOSITE TOP British Purchasing Commission acceptance pilots Chris Clarkson (centre) and Battle of Britain ace Michael 'Red Knight' Crossley (right) pose with L A Costello, the resident technical officer with the British Air Commission

RIGHT They had good reason to cover their ears – these NAA workers are subjected to the rigours of a cannon test on a Mk IA which was fitted with four 20 mm weapons in place of the machine guns. The aircraft has been jacked up into flying attitude and a battery cart provides power via a plug on the right side of the fuselage. To have the laminar flow airfoil work most effectively, the paint and skin condition of the wing was supposed to have been maintained without scratches or marring – something not evident on this aircraft!

NORTH AMERICAN AVIATION INC.

CHAPTER 3

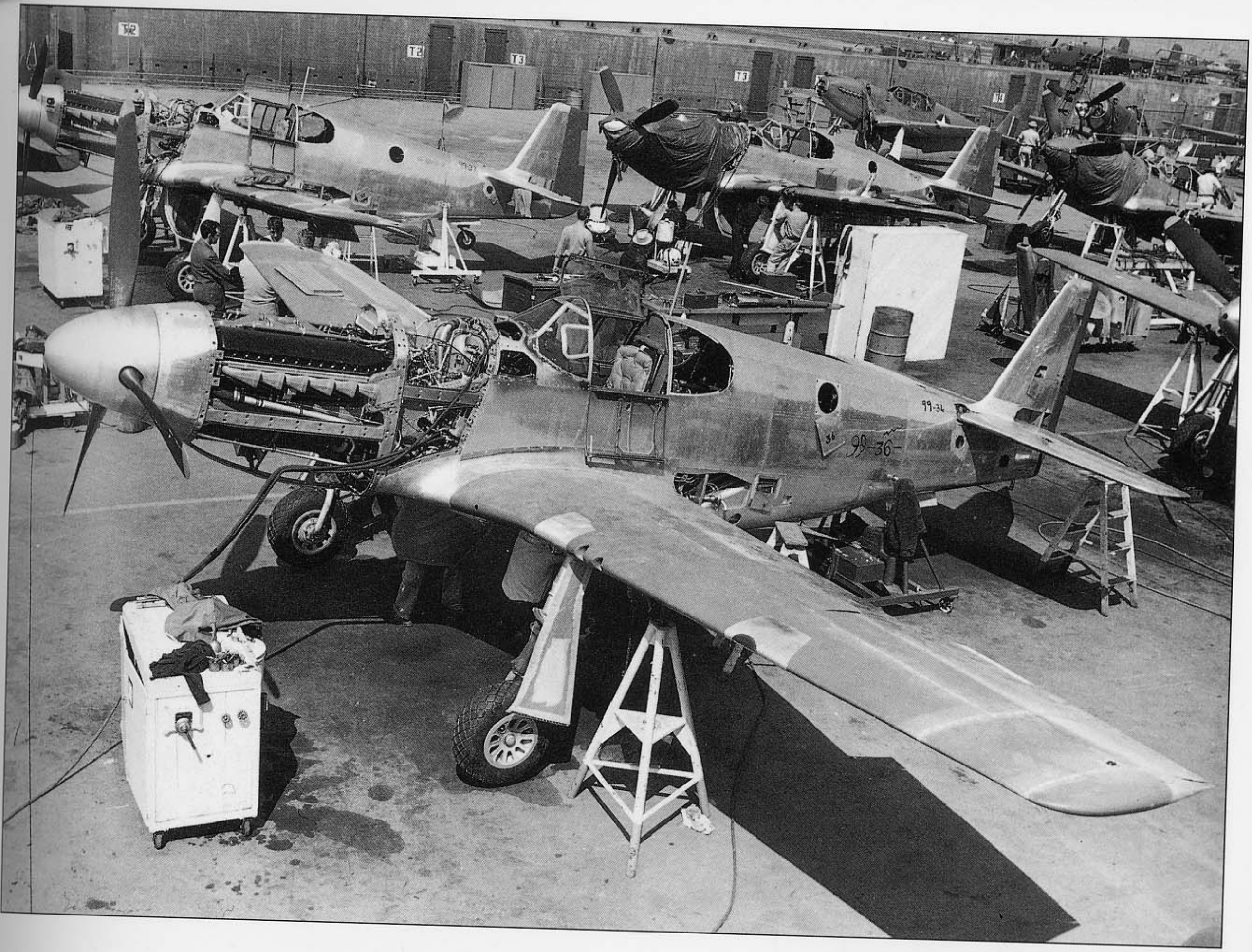
PONY SOLDIERS

WHEN AMERICAN GOVERNMENT APPROVAL was given to allow North American and the British to proceed with the development of the NA-73, one of the conditions the former insisted upon was that the fourth and tenth production aircraft be handed over to the Army Air Corps. An Authority for Purchase document (number 165265) was issued on 24 July 1940 and called for the delivery of the two aircraft with the AAC designation of XP-51. On 20 September of that same year, an official contract was approved by the Assistant Secretary of War.

The two prototypes were built in accordance with the British Model Specification, although certain modifications were also made to accommodate standard Army equipment. As with the British aircraft, the wings consisted of two panels bolted together at the centre plane of the fuselage. The main and rear spars were of flanged aluminum alloy sheet construction, with the flap and aileron hinge supports mounted on the rear spar. The remaining structure consisted of extruded stringers and pressed ribs, onto which a skin covering of aluminum coated aluminum alloy was rivetted. Space between the main and rear spars on each side of the centreline was arranged to hold the fuel cells, a structural door being provided in the under surface of each wing section to facilitate their installation and removal. The ailerons were of the sealed balance type.

The fuselage construction at the cockpit section consisted of two curved side panels, four longerons (two on each side of the cockpit) forming its structure together with the outer skin, which was reinforced by vertical frames. Aft of the cockpit, the longerons extended into a semi-monocoupe structure reinforced by vertical frames. All skin and frames were aluminum coated aluminum alloy. The fuselage was divided into three sections – the engine section, the main section and the tail section. All sections were detachable, and attached with bolts.

The tail unit was a full-cantilever structure with a semi-monocoupe fin and stabiliser, the latter being constructed as one unit with detachable tips. The full-cantilever metal-covered structure consisted of two spars, aluminum alloy ribs and extruded stringers.



The elevators was made up of two sections, each interchangeable with the other, and were of fabric-covered aluminum alloy construction. The structure consisted of a front spar, a short intercostal rear spar, flanged ribs and metal leading and trailing edge sections. Both elevators were static balanced and equipped with trim tabs, which were controllable from the cockpit for longitudinal trimming of the aircraft under all flight conditions.

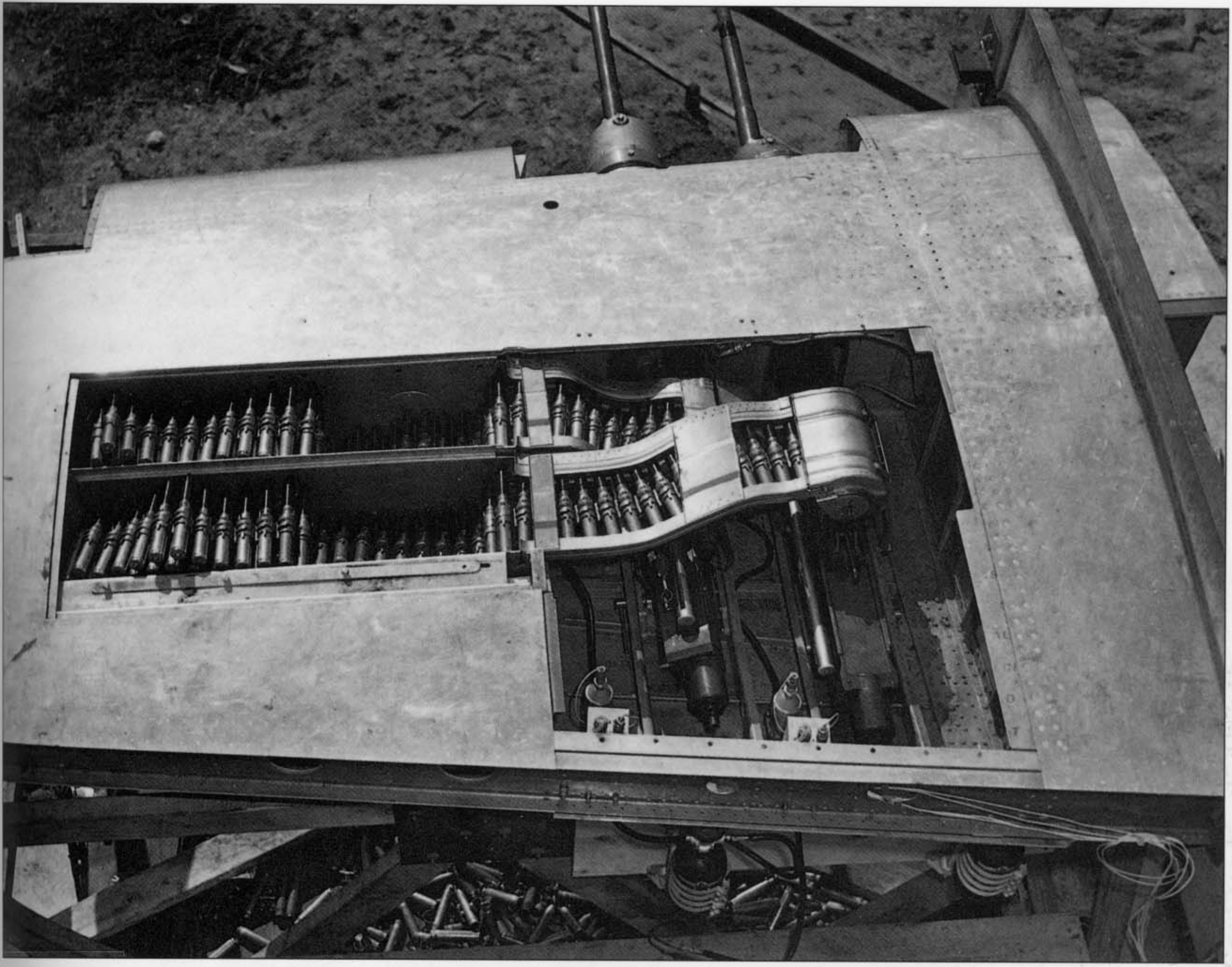
The vertical stabiliser was a full-cantilever semi-monocoque structure consisting of a forward and rear spar, flanged ribs and extruded stringers. The rudder was similar in structure to the elevator, being fabric covered and dynamically balanced. It was also equipped with a trim tab controllable from the cockpit for directional trimming of the aircraft under all flight conditions.

The landing gear comprised two main landing gear assemblies and a steerable tail wheel, all of which were extended and retracted by hydraulic pressure. They were completely enclosed by fairing doors when retracted. The tail wheel was capable of swivelling 360° and was steerable within the range of the rudder pedal travel. The main landing gear wheels were fitted with hydraulic brakes.

Detailed factory view of P-51As undergoing final completion outside the NAA factory. During this time period the company was rapidly expanding, and some of the final work had to be completed outside. Note how the aircraft are on jacks, and that the NA-99 designation has been applied to the rear fuselage of each aircraft, along with the last two digits of the manufacturer's construction number. Also note the additional windscreen window

Production of the new fighter for the British rapidly moved forward and on 20 May 1941 Robert Chilton made the first XP-51 flight in AAC s/n 41-038. Although progress with the British aircraft was relatively rapid, the same could not be said of the American Mustangs. The first XP-51 arrived at Wright Field on 24 August while the second XP-51 (s/n 41-039) did not get to that location until 16 December – the two aircraft had been scheduled to arrive in February and March! Expansion of the American aircraft industry to face what would apparently be a certain entry into the war in Europe saw North American issued with a contract for 150 P-51s on 7 July 1941 – well before the two XPs had been tested.

In a report submitted on 15 July 1942 regarding the XP-51, Capt W G Logan commented, 'Except for minor incidental changes, the project progressed at a normal rate. On 24 February 1942, an Engineering Order was issued to remove the original hydraulic gun chargers out of both airplanes and install in lieu thereof fully automatic gun charger equipment which was being developed by the Bendix Corporation in the second airplane. This was done so that the new charging equipment could



LEFT Looking not unlike the NA-73X (and often identified as such in reference books), the first XP-51 poses for its portrait on the NAA ramp. USAAC s/n 41-038 was rolled out of the factory in a highly polished natural metal finish (after its RAF paint had been stripped) with the classy red, white and blue tail stripes that were soon to be eliminated as the threat of war increased. The military requested that NACA perform flight tests on the aircraft, and it was duly flown to Langley, Virginia. Testing commenced on 1 March 1942, and was finally completed on 15 May of the same year. The aircraft was flown for an accumulated total of 24 hours while fitted with special instrumentation, including accelerometers, turn meters and a timer. A recording yaw vane was also added on a boom that extended four feet from the right wing tip, whilst an airspeed boom was mounted from the left wing tip. The XP-51 created history during these trials as it was the first aircraft to feature a low drag airfoil to be tested by NACA. During testing, a maximum load factor of 8 G was calculated, along with a terminal velocity of 0.82 Mach

ABOVE This mock-up section of wing was used for testing the 20 mm cannon. Some pilots felt that the increased weight of these weapons decreased the type's overall performance. Note spent cartridges under wing

be flight tested at an early date. Since the delivery installation, it was decided that provision only would be made for installation of this equipment.

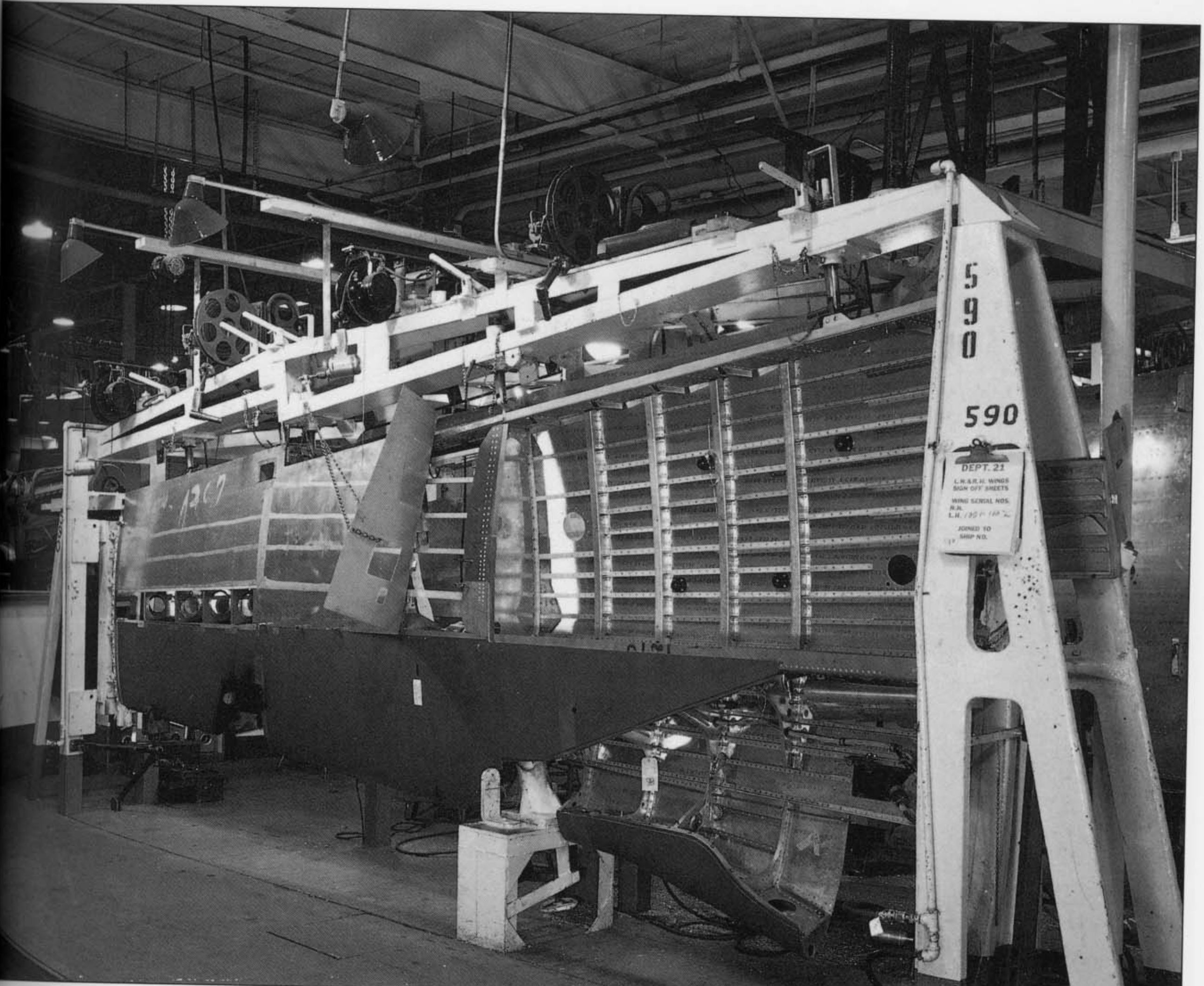
'Preliminary flight testing was conducted on the first airplane at the contractor's plant by the contractor's personnel and government pilots in accordance with the terms of the contract. Considerable trouble was incurred with the Allison engine installation in the early stages of the airplane's development. At one particular throttle setting, the engine was found to be extremely rough and, in one instance, the engine completely cut out resulting in a forced landing in a ploughed field. This landing was made by the contractor's pilot without damage to property or personal injury, although considerable damage was done to the airplane (*author's note: this refers to the NA-73X, and apparently does not take into account the fact that the accident reports indicated that the pilot had run one tank dry*).

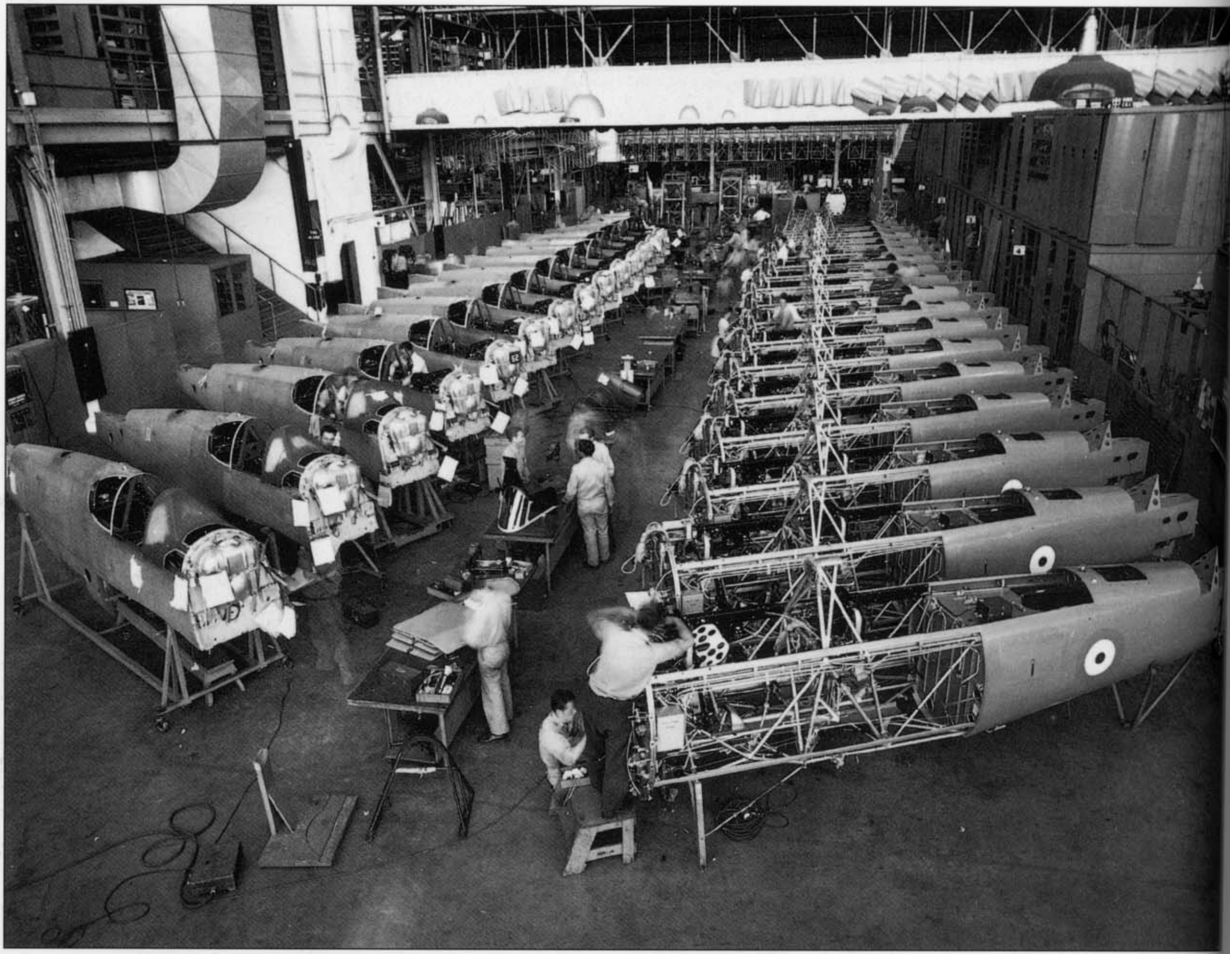
'Under the terms of the contract, the Army was supposed to receive the fourth and tenth production articles. These airplanes were scheduled for delivery in February and March 1941. The production of the NA-73 was delayed both by the crash landing of the experimental model and the delay of the engines for the British airplanes. To facilitate the delivery of the XP-51 models it was decided to take the fourth and tenth articles from their place in the assembly line and install the Army engines in them for delivery to Wright Field. This procedure was followed and the first airplane was accepted at the plant of the contractor and flown to Wright Field on 24 August 1941, for the purpose of conducting official performance tests.

'Upon arrival of the first airplane at Wright Field, a safety inspection was conducted. The airplane was next weighed and balanced and an actual weight and balance report prepared. Before flight testing could be conducted, it was necessary to install backfire screens to prevent damage to the airplane due to

LEFT Wearing temporary American markings for flight testing within the United States, Mustang Mk IA is prepared for its next sortie. The aircraft was finished in Dark Green and Dark Earth upper surfaces with Sky under surfaces, whilst the spinner was in Dark Earth. AM190 went to the Aeroplane and Armament Experimental Establishment (A & AEE) at Boscombe Down for further testing, before being assigned to No 516 Sqn. The aircraft was struck off charge on 31 October 1945. The Mk I led directly to the American Mustangs

BELOW Master wing jig for the P-51A, which allowed for precise construction of the unit. At this point, the main landing gear leg had not been added, but the forward 40 per cent of the wing had been filled and primered. Note that the interior is bare metal and devoid of zinc chromate. The completed wing would house two 90 gal fuel cells that would weigh 1080 lb when full





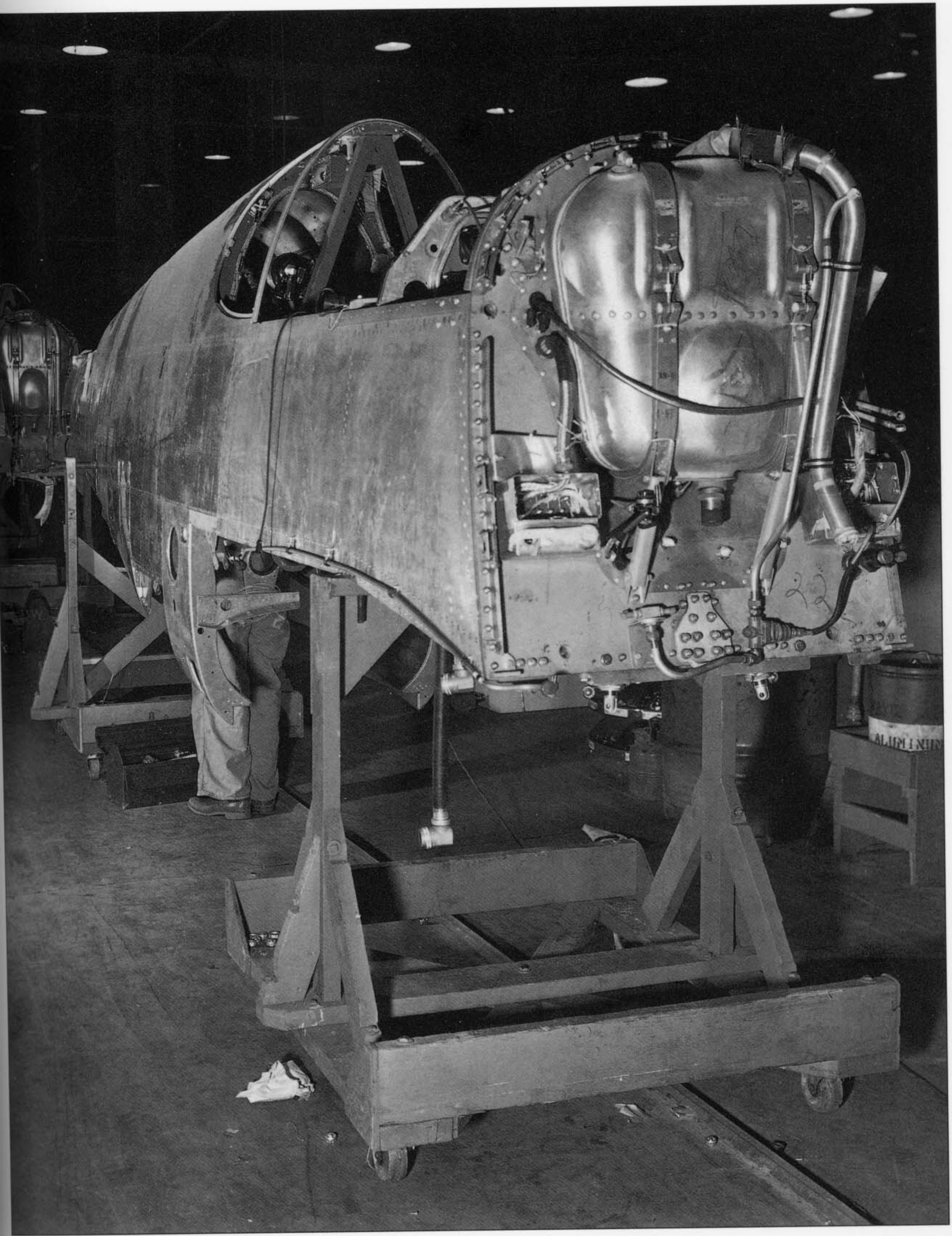
engine backfire. This work took considerably longer than was anticipated due to the breaking off of studs. It was also necessary to install new aileron and flap bracket bolts to correct an unsatisfactory condition found by NAA in other airplanes. The replacement parts were furnished by the contractor and installed by Army personnel under the supervision of the contractor's representative.

'Additional flight tests were conducted on the two airplanes delivered to the Army. It was during flight testing of the first Army airplane that it was discovered that engine difficulties previously encountered could be overcome by increasing the length of the ramming air intake scoop. It was only after the contractor considered the airplanes to be satisfactory that they were turned over to the Army.

'Preliminary performance tests were conducted at the contractor's plant by personnel on the contractor's first article during March 1941. Final official performance flight tests were conducted at Wright Field between 8 October and 22 December 1941. The reason for the long period of flight testing was due to the higher priority of other airplanes to be tested, bad weather

ABOVE As production at NAA built up, the Mustang line was modified several times to accommodate increased military orders. In this view, early Mustangs were being built along with Harvards for the RAF

RIGHT Early Mustang fuselages roll down a very crude production line, the former being mounted on rough wooden dollys fitted with castors for easy movement. The ten gallon oil tank has been secured to the firewall through the use of hefty straps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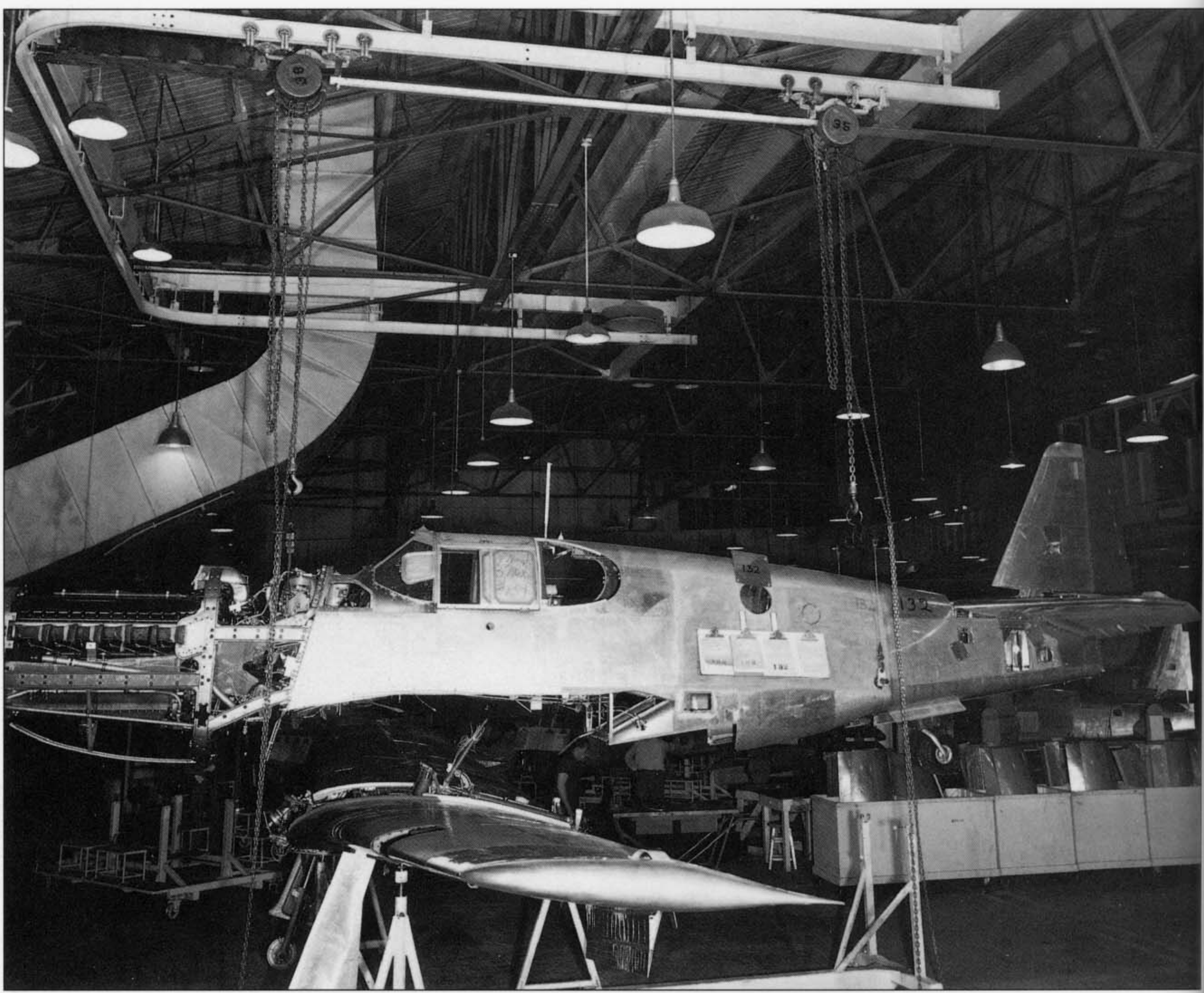
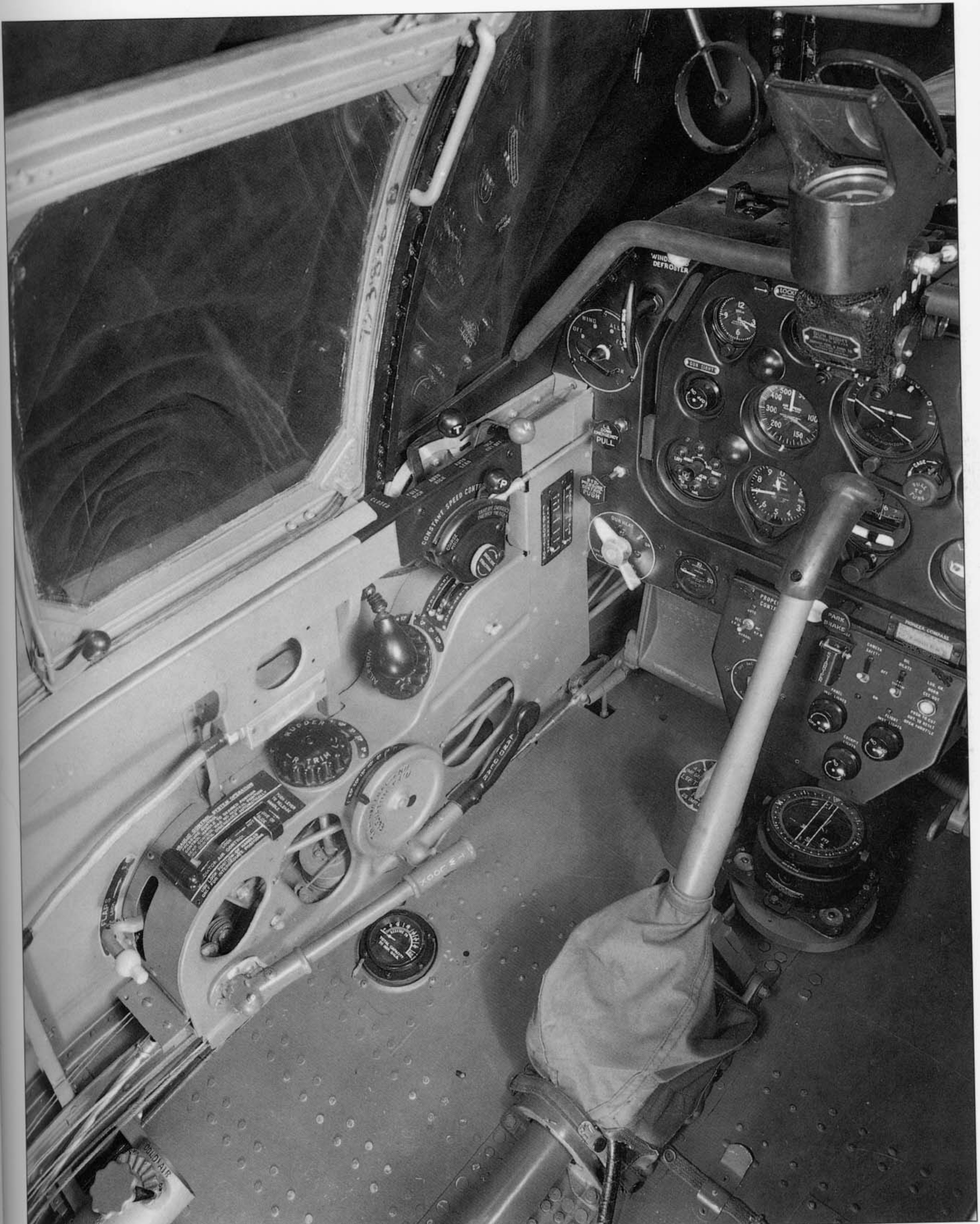
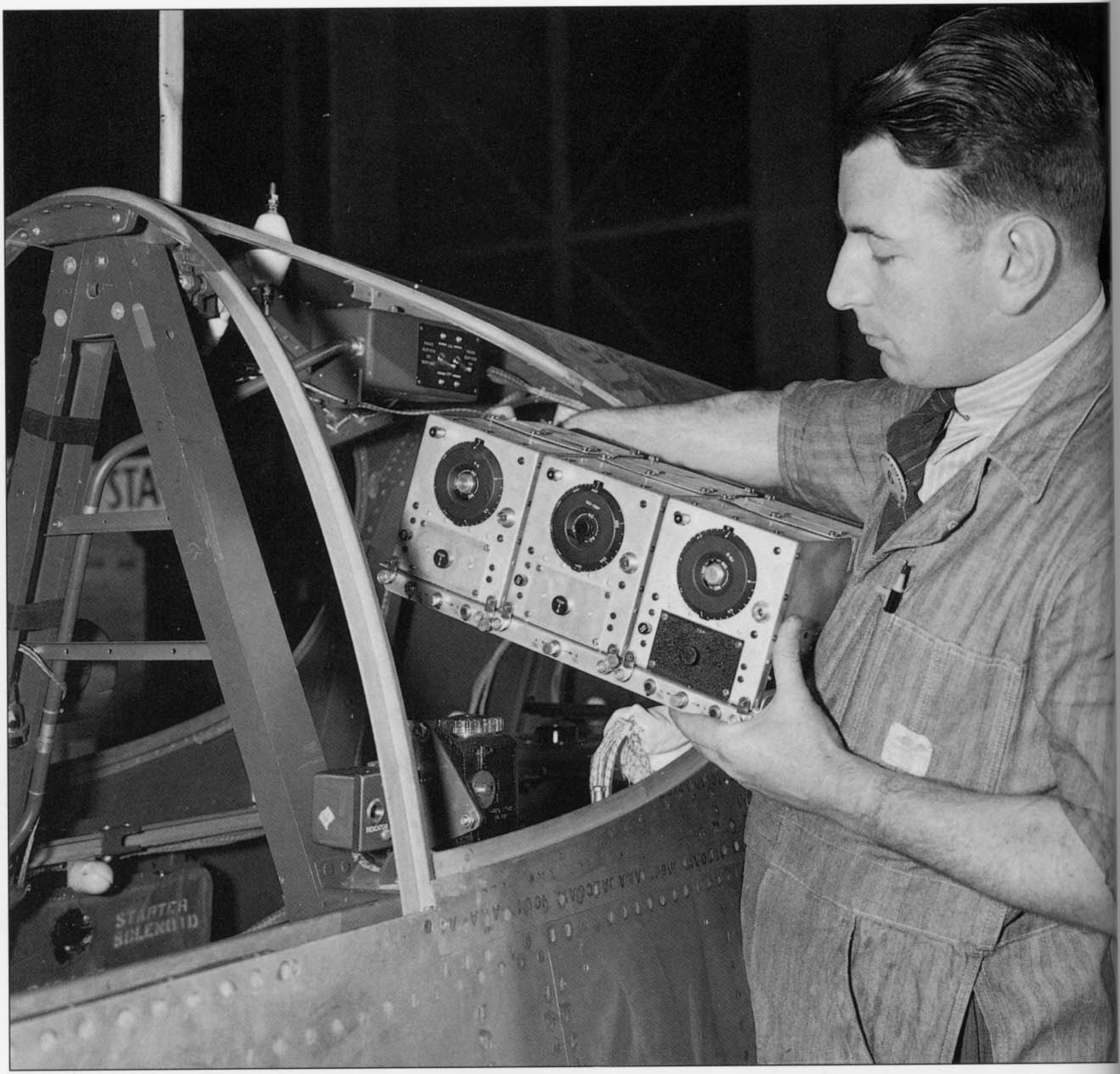


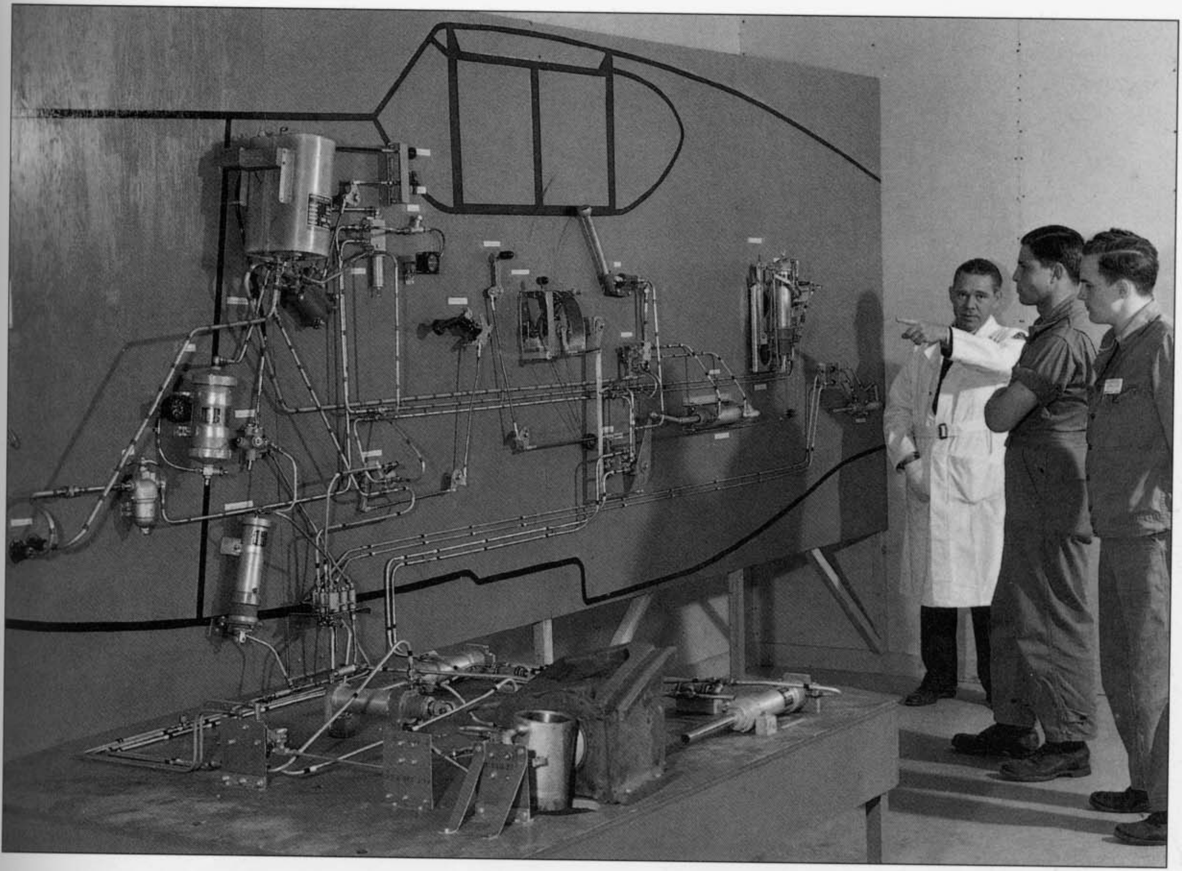
ABOVE A P-51A fuselage is mated to its wing. The aircraft carries the constructor's identification number 132 painted on strategic areas of the outer fuselage and inside panels. The clipboards affixed to the fuselage are assigned to the particular aircraft and outline work that needs to be done. The squared off tips of the Mustang's flying surfaces not only eased production, but also resulted in reduced turbulence where they mated with the laminar airflow wing

RIGHT Cockpit of a P-51 with the pilot's seat removed. The large handle near the floor is the tail wheel lock. Note the ST1A gun sight, along with the ring-and-bead sight





Installing the SCR-274 command radio behind the P-51A pilot's position. This radio was the main communication between the pilot, ground bases and other aircraft. The substantial roll over structure immediately forward of the radio compartment would save many pilots during landing or take-off accidents

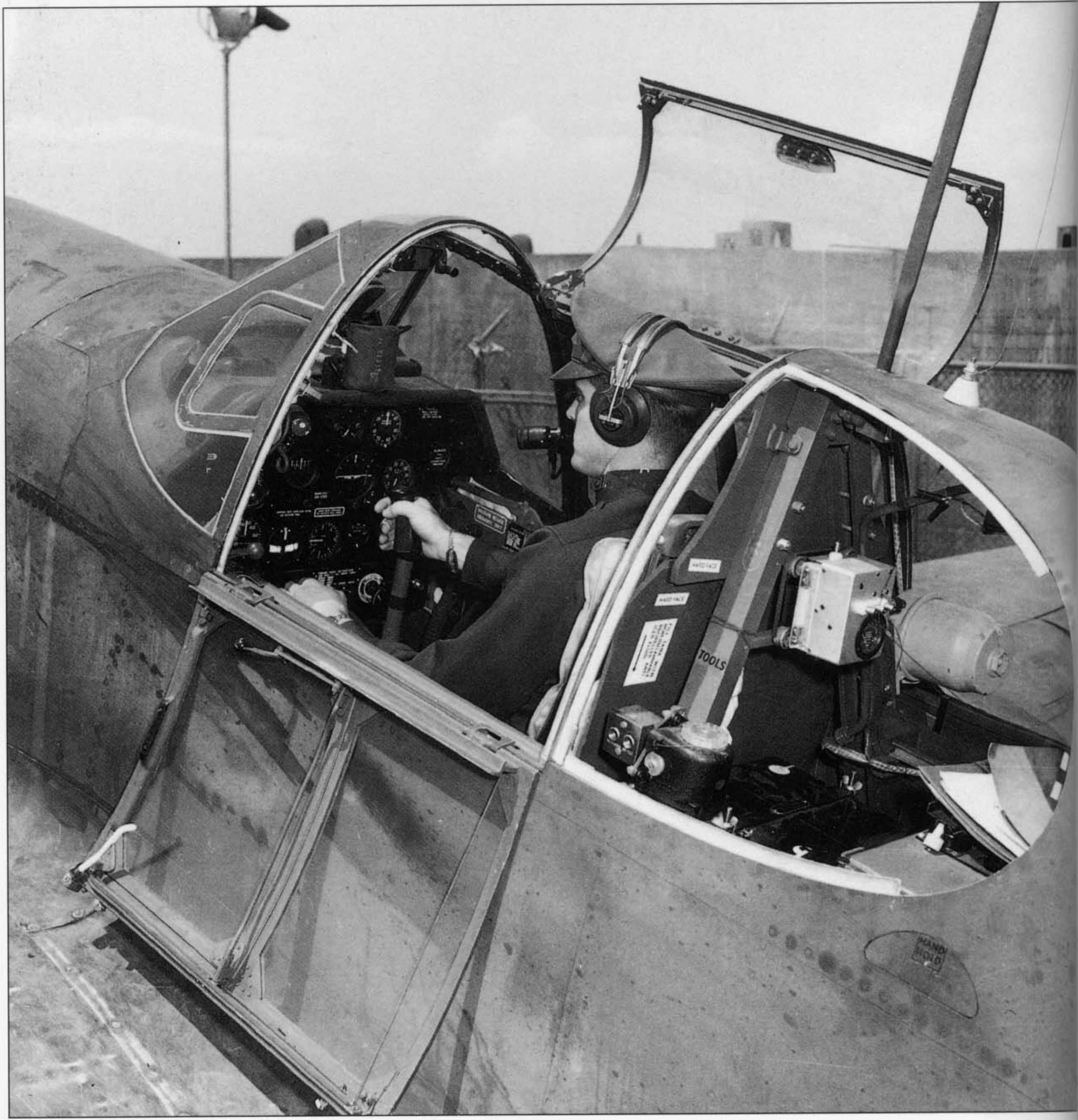


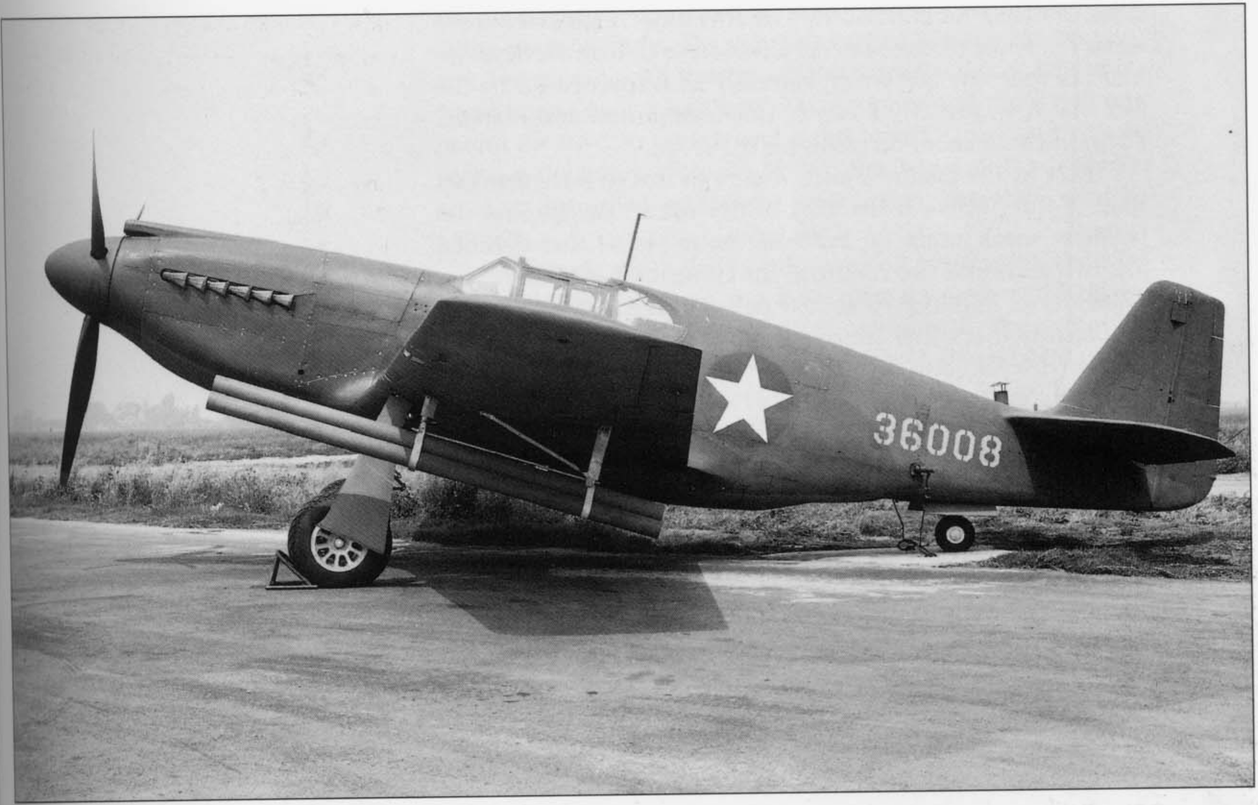
ABOVE This teaching aid displays the Mustang's relatively simple hydraulic system

LEFT Fitted to its dolly, a completed P-51A tail cone assembly is ready to be moved to the final production line

BELOW Highly detailed view of the cockpit of P-51A-1-NA s/n 43-6055, with the rear quarter panels removed for additional clarity. Original contracts called for the construction of 1200 P-51As, but this was drastically cut back to 310 aircraft when the Merlin engine was introduced to the Mustang airframe

RIGHT P-51A-1-NA s/n 43-6008 was retained at the factory for the installation and testing of bazooka-style rocket launchers. The P-51A was fitted with a three-bladed Curtiss C.53D-F-32/50700 electric propeller with aluminum blades – Mustang Mk Is had steel blades





and malfunctioning of the coolant scoop control and landing gear retracting mechanism during the cold weather. These difficulties and others of a minor nature were corrected by Army personnel and the contractor's representatives. The second airplane was thoroughly inspected by the Flying Branch after delivery and was then turned over to the Armament Laboratory for firing tests.'

Although it is apparent that the aircraft, as with any new type, had some developmental problems it is also obvious that the military either took their time solving them, or simply forged ahead on testing other types at hand. However, given the final overall contribution of the Mustang to the Allied victory, one must wonder just what they were thinking. The few supporters of the new aircraft had a long and hard fight ahead to make sure that development would continue, and the warplane would enter service.

During December 1941, North American was building $3^1/2$ Mustangs per day to fulfil the British order, but Kindleberger felt that he could raise production to a whopping ten fighters per day within three weeks of a substantial Army order. Col Homer Sanders, frustrated commander of the 51st Fighter Group in India, whose pilots were finding it increasingly difficult to fight superior Japanese equipment in P-40s, commented on 26 August 1942 that, 'Apparently the go-ahead signal was not given (for Mustang production) or there would certainly be some available for combat duty by this time. It appeared there was a tendency by the Material Division to hinder the development of this airplane, which can only be accounted for by the fact that it was strictly a North American project and Material Division could claim no credit for it'.

Back at the factory, North American was in a tremendous state of flux. Between the start of the war in Europe and the Japanese sneak attack on Pearl Harbor (a period that spanned just two years and two months), the company had gone from a capability of building 70 aircraft per month to a mass-production facility that could churn out 325 aircraft in the same time period. This had also been a period of frantic hiring, the company swelling from 3400 employees to over 15,000, with buildings being rapidly erected to handle production.

With the 150 P-51s now under production, the Air Corps decided to convert 57 of these airframes into armed photo reconnaissance aircraft for use in Europe and North Africa, while the remaining 93 Mustangs on the order were transferred back to the RAF as Mustang Mk. IAs. It is interesting to note that

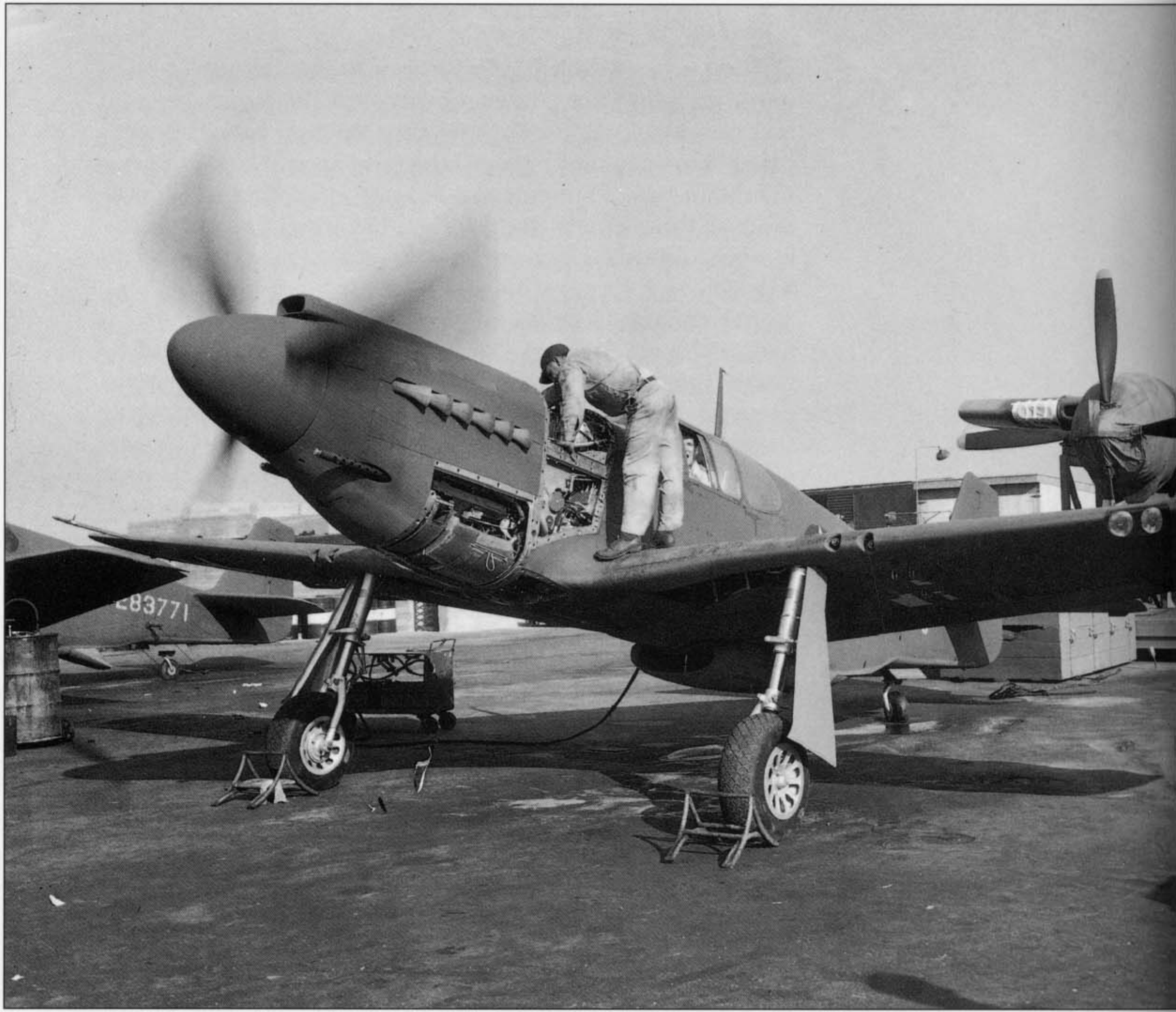
all these aircraft were fitted with four 20 mm cannon in place of the machine guns. The cannons carried 125 rounds per gun, and five rounds with linkage weighed three pounds. This compared to one pound for three .50 cal rounds and links, and one pound for five .30 rounds and links. North American's cost to produce these aircraft was $26,741, but when profit and government furnished equipment were added, the price went to $58,698.

Of the aircraft pulled for photo-recon conversion, the 33rd and 102nd airframes in the P-51 contract were withheld by North American for experimental engine work. The prototype camera installation was undertaken at NAA (P-51-1-NA), while the remaining 54 were depot modified as P-51-2-NAs, but were later redesignated F-6As. In an attempt to given this variant some special distinction, the name Apache was briefly adopted.

The Air Corps' next order was for a P-51 of a different flavour. On 16 April 1942, contract AC-27396 called for the construction of 500 NA-97s – what would become known as the A-36A. The effect of the Luftwaffe's dive-bomber, or *Stuka*, forces had been horrifyingly portrayed across the country's newsreel screens early in the war, and to the public, and perhaps the military too, the dive-bomber was a terrifying threat that seemed unstoppable. Only experience would prove that the dive-bomber, although highly effective in its designed role, was at the mercy of a strong fighter force. The Air Corps realised that it lacked just such a weapon, so North American, with the minimum number of modifications, converted the P-51 into a dive-bomber – the A-36. This aircraft featured speed brakes built into the top and bottom wing surfaces, along with a bomb rack under each wing. Fitted with six .50 cal machine guns and 200 rounds per gun, the A-36A (briefly named Invader) would become an important stepping stone in the development of the Mustang, since it added a very effective ground attack role to the aircraft's profile.

A-36A-1-NA s/n 42-83934 is raised in a cradle for the test firing of its weapons. The bomb racks were set closer to the landing gear to benefit from the greater strength of the wing structure. A-36 production totalled 500 aircraft (NAA c/n 97-15881 to 16380), and consideration was later given to putting the type back into production since it had proven so effective, but Merlin production had by that time completely eclipsed the Allison line

With the awarding of the A-36 contract, and further testing on earlier aircraft underway, the momentous decision was made to order a fighter variant of the Mustang for the Air Corps. Fitted with the new Allison V-1710-81, 1200 examples of the P-51A were ordered on 23 June 1942 under contract AC-30479, with the factory designation NA-99. As production forged ahead, reports were coming back from the combat fronts calling for modifications or improvements to the basic design, and one of these was a sand filtering system for the Allison carburettor since North African sand was reducing reliability of the Allisons. The P-51A would be fitted with four .50 cal Brownings (two in each wing panel) and associated magazines to carry 1260 rounds of ammunition. As with virtually any other combat aircraft, weight began to grow as the aircraft neared series production – the combat load of the A-model was 8600 lbs, and this further increased to 9600/10,300 lbs if 75/150 gal drop tanks were fitted.



With the awarding of the P-51A contract, extremely high levels of mass production were planned at North American, and assembly lines capable of constructing 20 aircraft per day were set in place. The need for new fighters was so great that the original contract for 1200 P-51As was supplemented with further orders for 1050 aircraft. However, the P-51A was to become a fairly limited production fighter as orders were soon slashed to just 310 aircraft. The reason for the drastic reduction in numbers was that the Mustang airframe had been mated to the vastly superior (at medium to high altitude) Rolls-Royce Merlin soon after production of the P-51A had commenced. Combat history would soon be made . . .

To convert the basic Mustang design into the A-36A, NAA engineers expended 40,000 man-hours of work – one such modification following the fitment of dive brakes saw the pitot tube relocated to the starboard wing. The A-36A retained the NA-73's nose-mounted .50 cals, however. Mechanics are seen here running up the Allison V-1710-87 prior to the aircraft's acceptance by the military. Note the dual landing lights in the leading edge of the left wing

CHAPTER 4

ON TO BERLIN

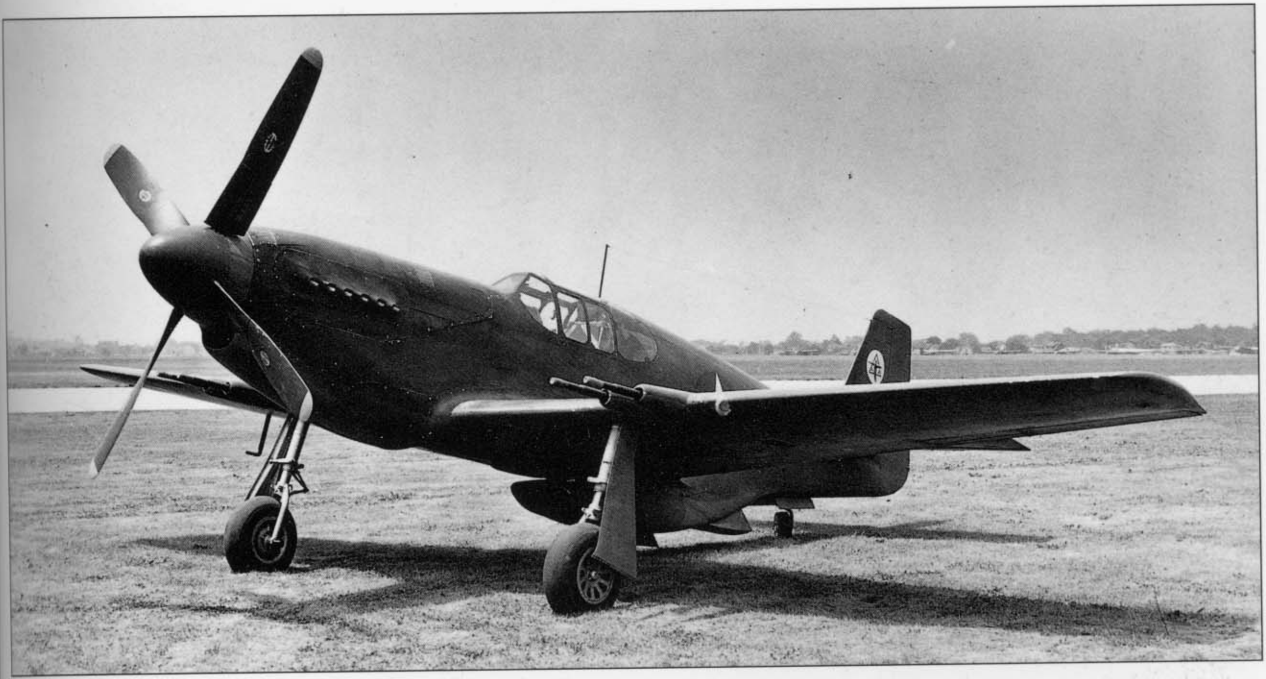
WITH THE ALLISON-POWERED Mustangs, North American, the USAAF and the RAF realised they had an excellent airframe mated to a not-ideal engine. However, this was not a criticism of the V-1710, for the engine performed very well within the regime for which it had been designed. However, as the war rapidly progressed, it became obvious that the air war was going to be fought at great altitudes – an arena for which the Allison was not suitable.

Sometimes a momentous trend starts out in a thoroughly mundane manner. During 1942, Wg Cdr Ian Campbell-Orde, commanding officer of the Air Fighting Development Unit (AFDU) at Duxford, called his friend Ronnie Harker and told him that one of the new Allison Mustangs was at the base, and invited him to come and fly the fighter. Harker, Rolls-Royce's service liaison pilot, quickly accepted the invitation and headed to Duxford, where he flew Mustang AG422 (later abandoned in flight on 2 October 1943 when its engine quit while serving with No 41 Operational Training Unit) on 30 April 1942. Harker had previously flown the Allison-powered Curtiss Tomahawk, and was very wary of American claims to high performance. However, he was most impressed by the Mustang, and the next day sent a report to Rolls-Royce which, in part, read, 'This aircraft should prove itself a formidable low and mid-altitude fighter. It closely resembled a Bf 109F, probably due to its being designed by one of the Messerschmitt designers, who is now with the North American Aeroplane Co (this, of course, was incorrect, as Schmued was never employed by Messerschmitt, but this started a trail of misinformation that would bother the designer for the rest of his life). The point which strikes me is that with a powerful and good engine like the Merlin 61, its performance should be outstanding, as it is 35 mph faster than a Spitfire V at roughly the same power'. Harker's quick calculations showed that the Allison Mustang was 30 mph faster at 5000 ft and 35 mph faster at 15,000 ft than the frontline Spitfire Mk V.

The top personnel at Rolls-Royce took his suggestions very seriously, and moved rapidly with a secret memo dated 14 May

1942 from E W (later Lord) Hives, general manager for Rolls-Royce Derby, stating, 'I feel myself that it might pay a very good dividend (the conversion to Rolls-Royce power), if it can be done quickly, to install the Merlin XX in this machine. It would be a relatively quick job, and might fill a very useful interim niche under existing conditions. I am endeavouring to obtain performance data about the aircraft so that the gain that might be anticipated can be estimated. I recall that Air Commodore R B Mansell and E T Jones, when in the USA, did suggest that the Packard should be fitted into the Mustang aircraft, but it did not get any further'.

However, the Air Ministry voiced some concern since a strong commitment had been given to the production of the Spitfire Mk IX. It felt that the modification of the Mustang would draw valuable resources away from getting the Mk IX into the frontline to combat the Luftwaffe's potent new threat – the Fw 190. This left Harker particular perplexed, and he later wrote, 'that my proposal was unrealistic, that the Air Ministry would not approve and that there would not be any engines available anyhow as they were all required for the Spitfires – and why waste time on an untried American-built aeroplane!'

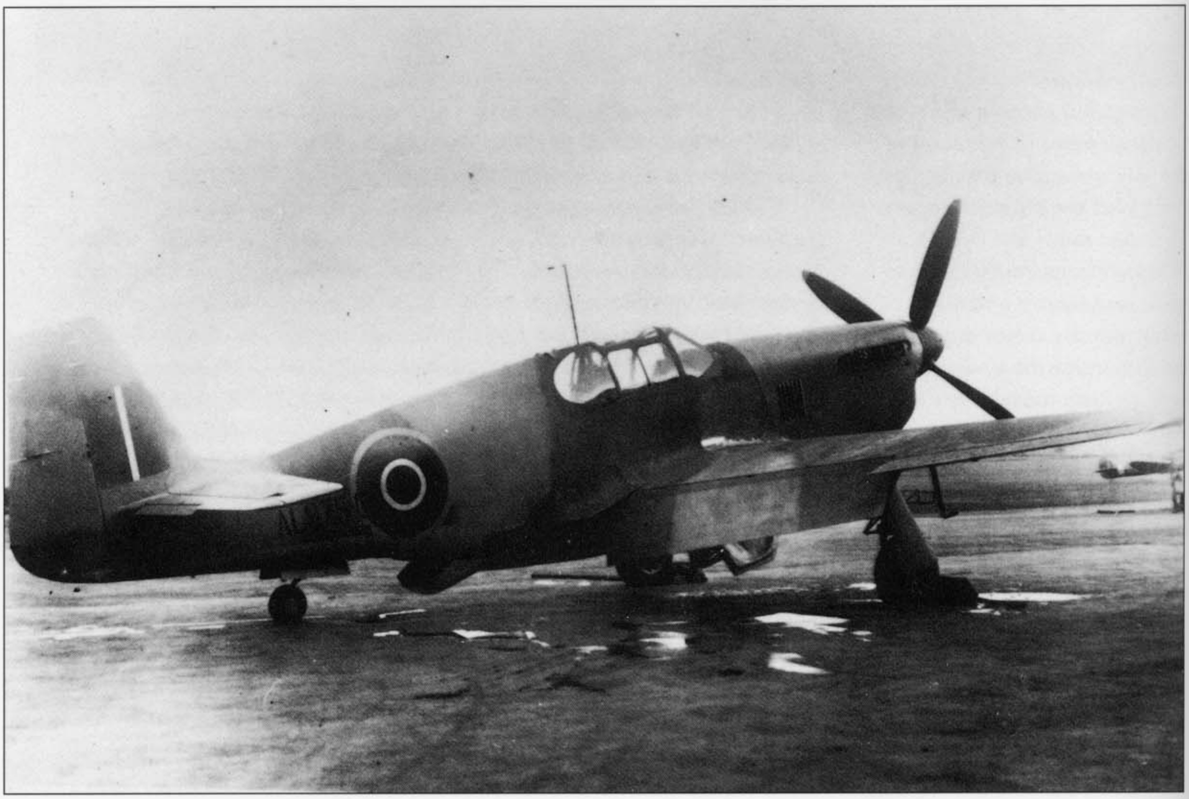


LEFT With its landing gear firmly chocked and tail raised to simulate level flight attitude, a natural metal P-51B has its four .50 cal Browning AN M2 machine guns tested and bore sighted at the Inglewood factory. Building Mustangs had become an around-the-clock effort by this stage of the war, and engine runs and gun firing filled the night-time hours. This view shows the P-51B's Hamilton Standard 24D50 four-blade propeller to advantage along with the canvas dust covers installed inside the landing gear wells to keep the interiors free from dirt and grime. However, in the field, crew chiefs usually dispensed with the covers since the blocked access for maintenance. With the addition of the Merlin to the Mustang airframe, the four-blade wide chord propeller became necessary to absorb the increased power at higher altitudes. Also a new, and heavier, radiator was required for better cooling characteristics

ABOVE While Rolls-Royce proceeded with the creation of the Merlin-powered Mustang X, similar activity was taking place at NAA with P-51 USAAF s/n 41-37352 becoming the first American Mustang to fly powered by a Merlin. Finished in standard Olive Drab and Neutral Grey camouflage, the aircraft retained its four 20 mm cannon, but featured an entirely new air scoop similar to the eventual production standard item. Packard Motor Cars was licensed to build the Rolls-Royce Merlin 61 as the V-1650-3, and two early examples were shipped to North American for installation in the aircraft that would initially be designated XP-78. The contract for these conversions (USAAF s/n 41-37421 being the other airframe) was signed on 25 July 1942, with the factory designation NA-101 being assigned to the aircraft. Note the NAA logo on the vertical fin. The conversions were carried out in a building separate from on-going Mustang production, and although it appears that the conversion to carry a Merlin was fairly straightforward, it was not, and tens of thousands of engineering hours were expended to ensure that the modification work was a success. A new motor mount and cowling was required, while the forward fuselage had to be strengthened. Also, a new air scoop and radiator, as well as a supercharger, needed to be incorporated into the P-51 airframe. The V-1710 had tipped the scales at 1335 lbs (dry), while the Merlin weighed 1690 lbs. The latter's four-bladed Hamilton Standard propeller was also heavier than the Allison's 'three-blader'. Both the XP-78s retained the four 20 mm cannon of the P-51s from which they had been converted, but the intention from the start was to equip the production Merlin Mustang with four .50 cal Brownings

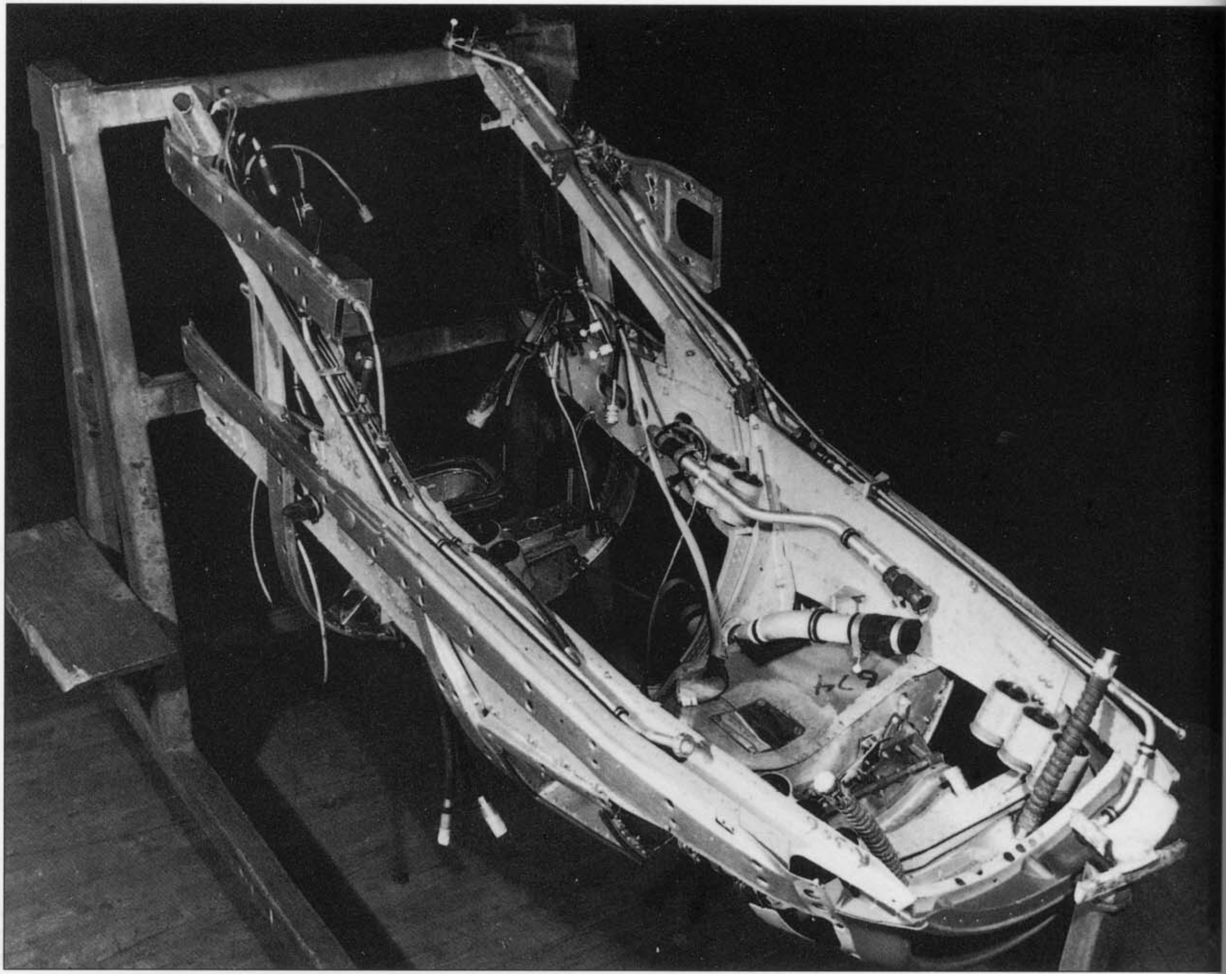
BELOW The Rolls-Royce conversions were more functional, and rather than being aimed at mass production, they were basically utilised to prove that the mating of the Merlin and Mustang would work. As the first aircraft so converted, Mustang I AL975/G (the G denoted that the aircraft was involved in a classified, and important, project, and should be kept under constant guard when on the ground) underwent several cowling changes. Fitted with a Merlin 65 driving a 10 ft 9 in diameter Spitfire propeller, the aircraft completed its first flight on 13 October 1942 with Capt R T Shepherd in command. On this flight a speed of just 376 mph was reached before the cowling started to come apart following a build up of pressure. Further modifications saw a dramatic rise in performance, and one Rolls-Royce official wrote to another, 'The speed realisation is most encouraging. Soon we shall have a scream for Mustangs instead of Spitfire IXs!' In the wake of the first flight Rolls-Royce engineers calculated that fitting the Merlin 65 to the Mustang resulted in the aircraft suffering a 44 per cent loss in directional stability – or the equivalent fin area of 3.8 sq ft. In order to rectify this situation, a joint Rolls-Royce/NAA dorsal fin modification was proposed, which added another two square feet of area. However, directional stability problems remained a feature of the Merlin Mustang until the introduction of the P-51H, with its taller vertical fin. As for AL975, the aircraft was operated by Rolls-Royce until struck off charge on 5 April 1945 and scrapped – certainly an unfitting end for such an historic aircraft

RIGHT This photograph is of interest since several sources have listed the aircraft featured as being the first NAA Merlin Mustang – s/n 41-37352. However, compare this photo with the identified shot of '7352 on page 49, and note that this aircraft has a completely fresh paint scheme and unpainted stainless steel exhaust shrouds. The aircraft also has the early national insignia and the landing gear oleos are extended to their maximum length, which may indicate that it lacks an engine or that the oleos were over-inflated for some other purpose. The most noticeable difference is that the wing is completely devoid of 20 mm armament. Note the barrage balloon in the background – Mines Field was ringed with these as a defence against a Japanese surprise attack



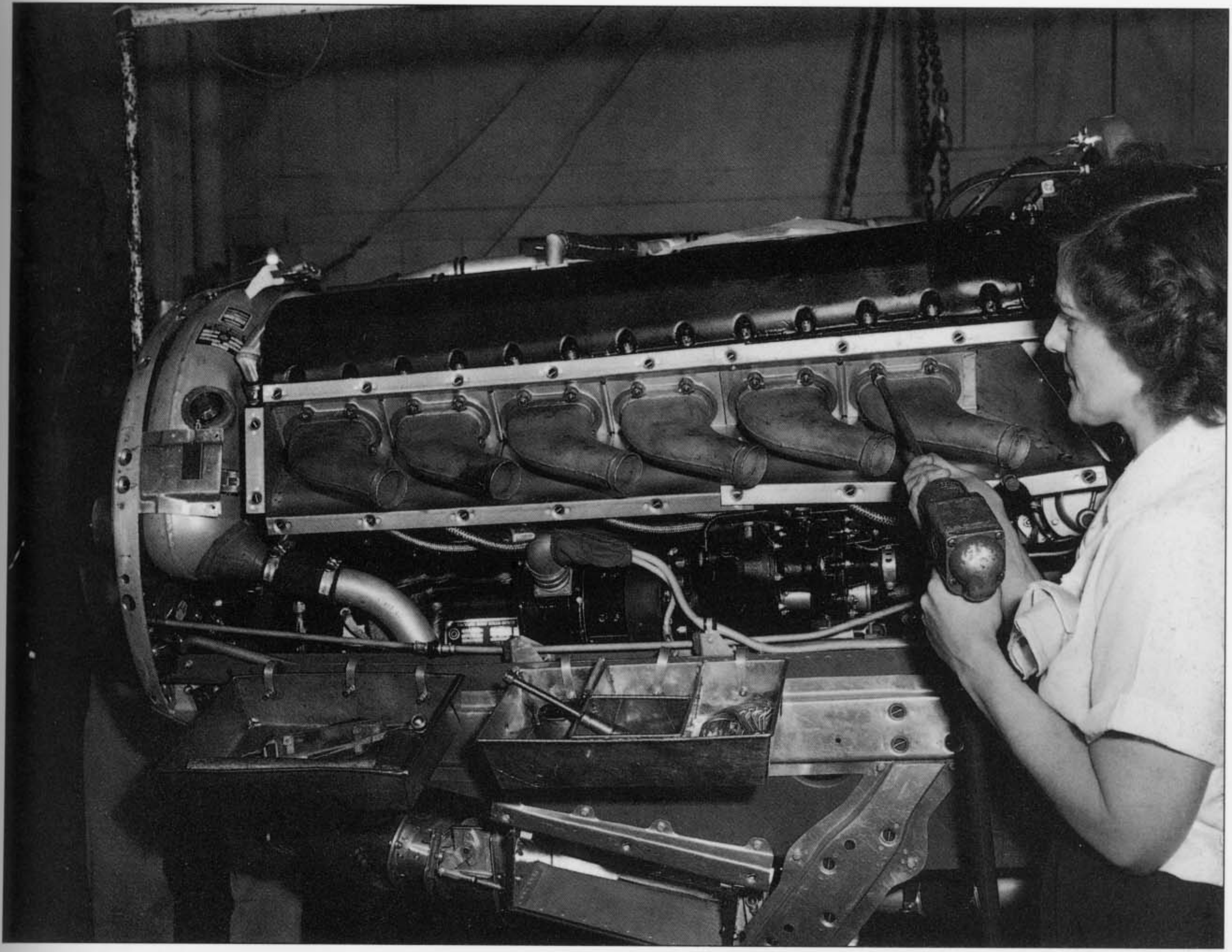
Despite official reluctance for the Merlin Mustang, E W Hives used his political power to have three aircraft transferred to the facility at Hucknall for conversion with Merlin powerplants. Rolls-Royce freely let North American know what they were doing. NAA was not unaware of the benefits of the modification, and one of the champions of the re-engining programme was Maj Thomas Hitchcock, assistant air attaché at the US Embassy in London. He issued the following memo, dated 8 October 1942, 'The reasons for the remarkably low drag of the Mustang are not fully understood on this side of the ocean. The English think it is only partly due to the laminar flow wing. The Rolls people became very much interested in the possibilities of the Mustang airframe with the Merlin engine. Estimates were made as to the speeds that could be obtained with the installation of the 61 and 20 Merlin. The Air Ministry instructed the Rolls people to install five Merlin 61 engines in Mustang airplanes. Simultaneously with this development it was arranged to have the North American Company install a Packard version of the Merlin 61 in the Mustang airframe. Requests were sent to the United States to have the Packard Company start manufacturing Merlin 61s as promptly as possible.

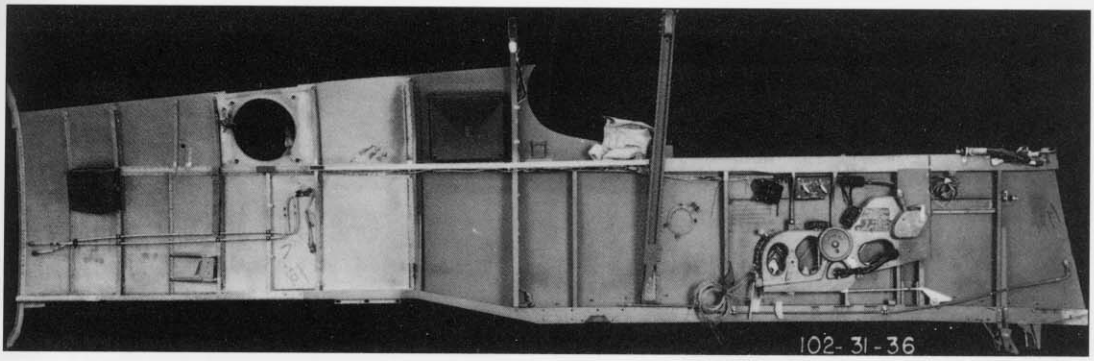
'The interesting qualities of the Mustang airframe were brought to the attention of General Arnold and Admiral Towers when they were in London June last, by the American ambassador (John C Winant), Air Chief Marshal Sir Charles Portal,



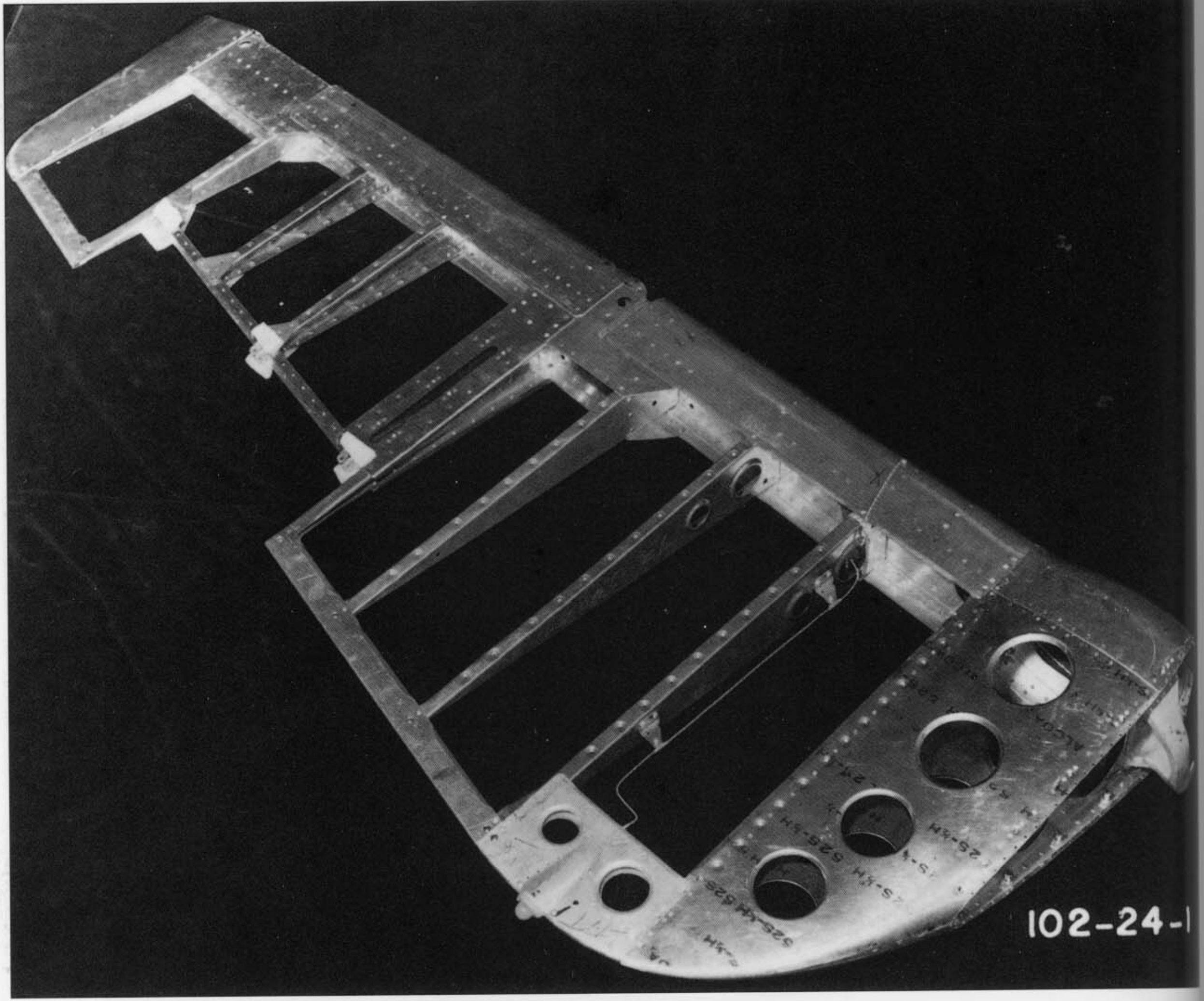
ABOVE A complete P-51B motor mount in a jig, awaiting installation on an airframe. Totally different from the Allison mount, the unit was relatively simple and very rugged. Once in combat, it was found that a thorough inspection of early P-51B engine mounting bolts and nuts was required, for the stress of high speed, high G, combat manoeuvring in early 1944 resulted in the Merlins tearing away from the airframes. Technicians soon discovered that the engine mounting bolts and nuts used on early P-51Bs were not strong enough to retain the Merlin under these condition. Replacement by bolts of greater strength quickly cured this deadly problem

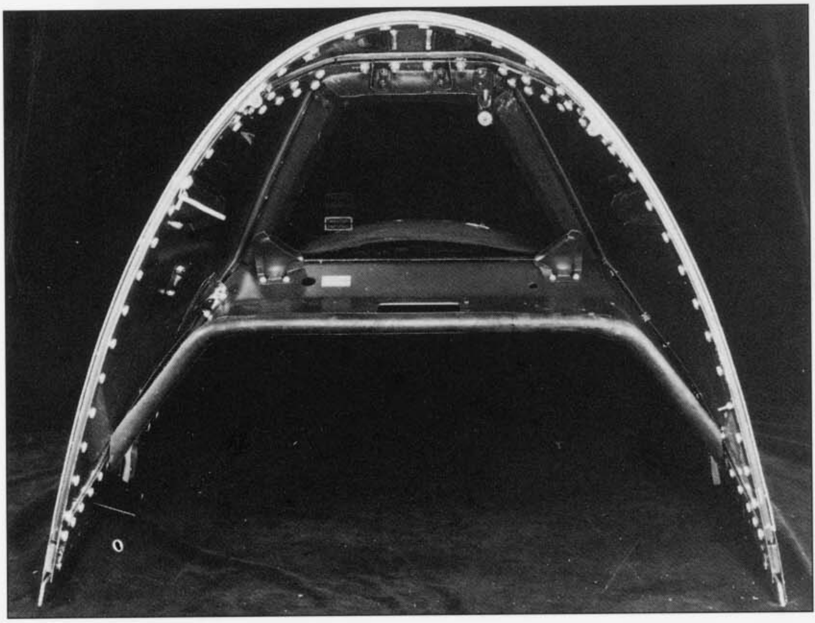
OPPOSITE RIGHT 'Rosie the Rivetter' torques exhaust stack bolts on a V-1650-3 as it rolls down the production line. Note the custom tool holders that would mount on the bare metal cowl former for easy access as equipment was installed. This view shows the header tank, which was a reservoir for engine coolant, and separated air from hot coolant exiting the engine. The header tank was a complex piece of equipment built by NAA and fitted with four Acme Aircraft castings (exit and filler nozzles). The V-1650-3 was equipped with a two-speed, two-stage, supercharger at the rear of the powerplant. The supercharger could produce a sea-level atmosphere within the induction system, and this allowed the Merlin to produce more horsepower at 25,000 ft than the Allison could at full take-off power – thus creating the power needed for the long escort missions into enemy territory





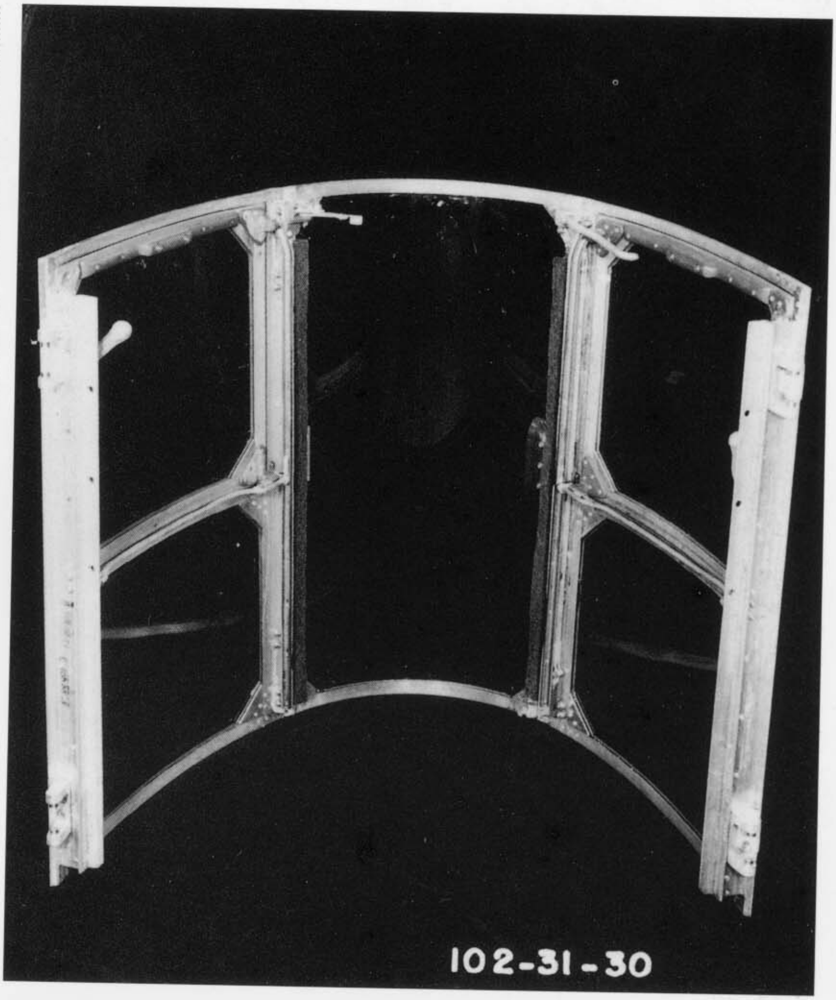
ABOVE Detailed view of the left side of a partial P-51B fuselage, showing the relative simplicity of the Mustang's construction. The gear handle, trim console and underwing stores salvo are all in place, as are the hydraulic lines for the retractable tail wheel. The large metal bar in the middle of the fuselage was part of the roll-over structure to protect the pilot, while the circular opening to the rear was an access panel for the fuselage cables. The brown leatherette aircraft documentation case was immediately behind the rear window. Note how the forward portion of the fuselage was painted in 'NAA Green', while the rear section was left in bare metal

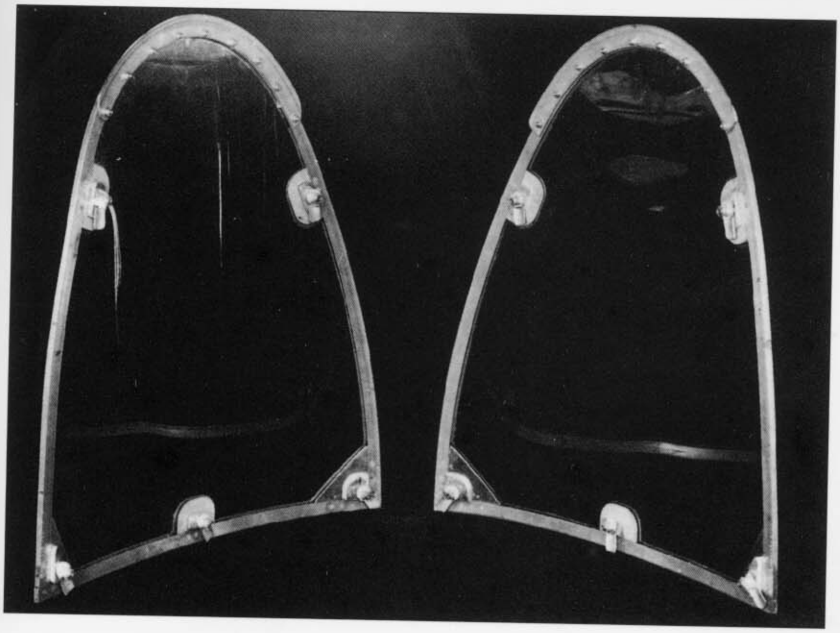


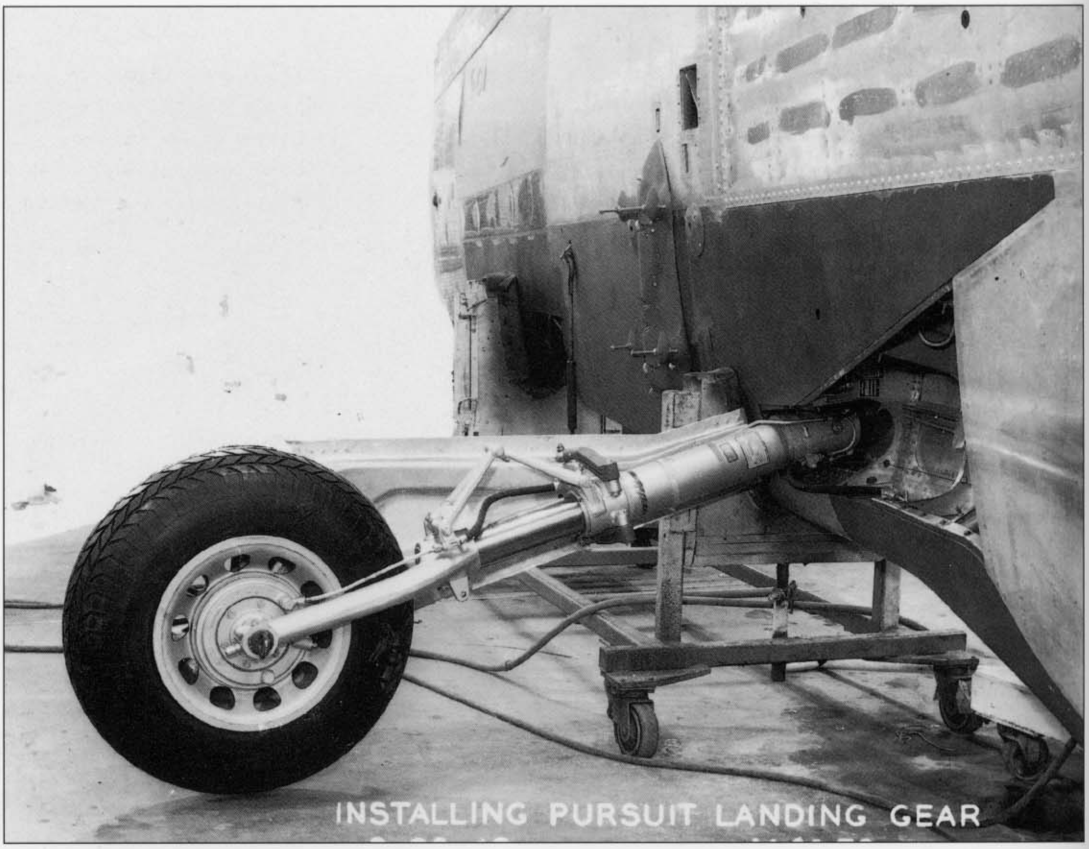


ABOVE Simple yet rugged, a P-51B rudder is seen before receiving its fabric covering. The recognition light and wiring are in place, but the large slot awaits installation of the phenolic resin trim tab. Written markings are still on the aluminum skin, and it is interesting to note that these units never received a protective spray of zinc chromate. The rudder utilised a single spar with flanged alclad ribs attached, a V-trailing edge piece and a beam for attachment of the trim tab. The leading edge of the rudder was cut out for the vertical tail's hinge fittings, the unit being hinged to the vertical tail with three sealed ball bearing fittings. The rudder was dynamically balanced with a 16.6-lb lead weight fitted to the top, while an additional balance weight at the bottom of the leading edge helped reduce static unbalance. The trim tab was also hinged by three sealed needle bearings

REMAINING PHOTOS The windshield, canopy structure and rear panel windows for a P-51B. Although it may look simple, the canopy frame work had over 1200 pieces. The main portion of the canopy had a panel on each side that could be manually slid to the rear by the pilot via the knobbed handles seen in the photograph. The flat forward section of the canopy was a five-ply, laminated 1 1/2 inches thick, bullet proof and slanted 31° back from the vertical when installed on the aircraft. The windshield's side and upper panels was 3/16 inch thick plexiglass







Interesting view of a main landing gear leg being installed in the wing of a P-51B. The landing gear was made under contract by Bendix. Note how the leading portion of the wing has received its layer of filler and a coat of primer. At this stage of assembly, the phenolic resin external stores shackle has also been installed. This photograph was taken on 26 August 1943

Chief of the Air Staff, Air Chief Marshal Sir Sholto Douglas, Commander in Chief Fighter Command, and Air Marshal F J Linnell, Ministry of Aircraft Production Research and Development. Robert Lovett, Assistant Secretary for War for Air, was also advised by letter, dated 5 June 1942, of the importance which English and various American representatives attach to the Mustang airframe and the desirability of energetically pursuing the Merlin development.

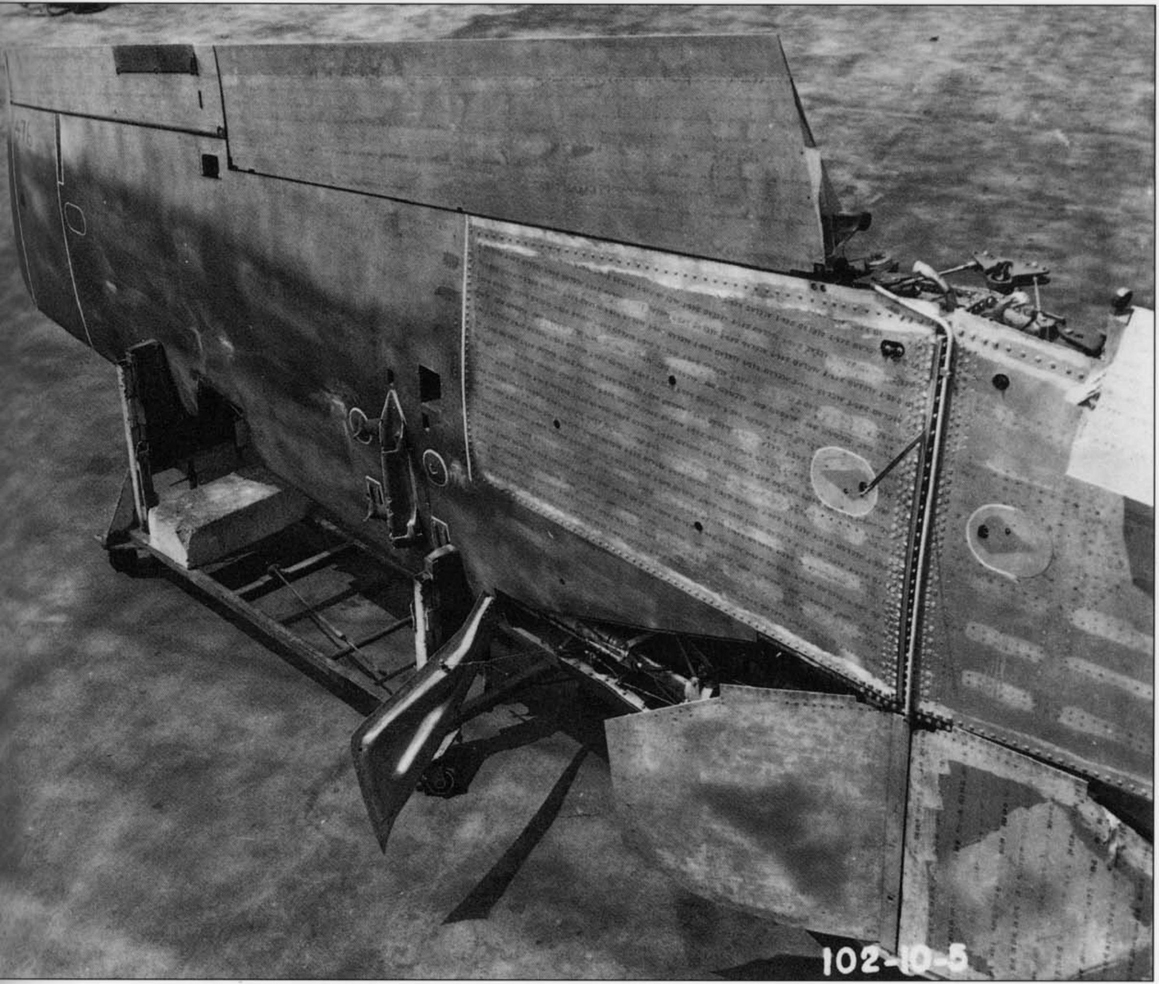
'Mr (Phil) Legarra, North American representative, reported when he came back from the US in the early part of September that the Mustang had the lowest priority that could be granted to an airplane.

'The Mustang is one of the best, if not the best, fighter airframes that has been developed in the war up to date . . . its development and use in this theater has suffered for various reasons. Sired by the English out of an American mother, the Mustang has had no parent in the Army Air Corps or at Wright Field to appreciate and push its good points.

'Important people on both sides of the Atlantic seem more interested in pointing with pride to the development of a 100 per cent national product than they are concerned with the very difficult problem of rapidly developing a fighter plane that will be superior to anything the Germans have.'

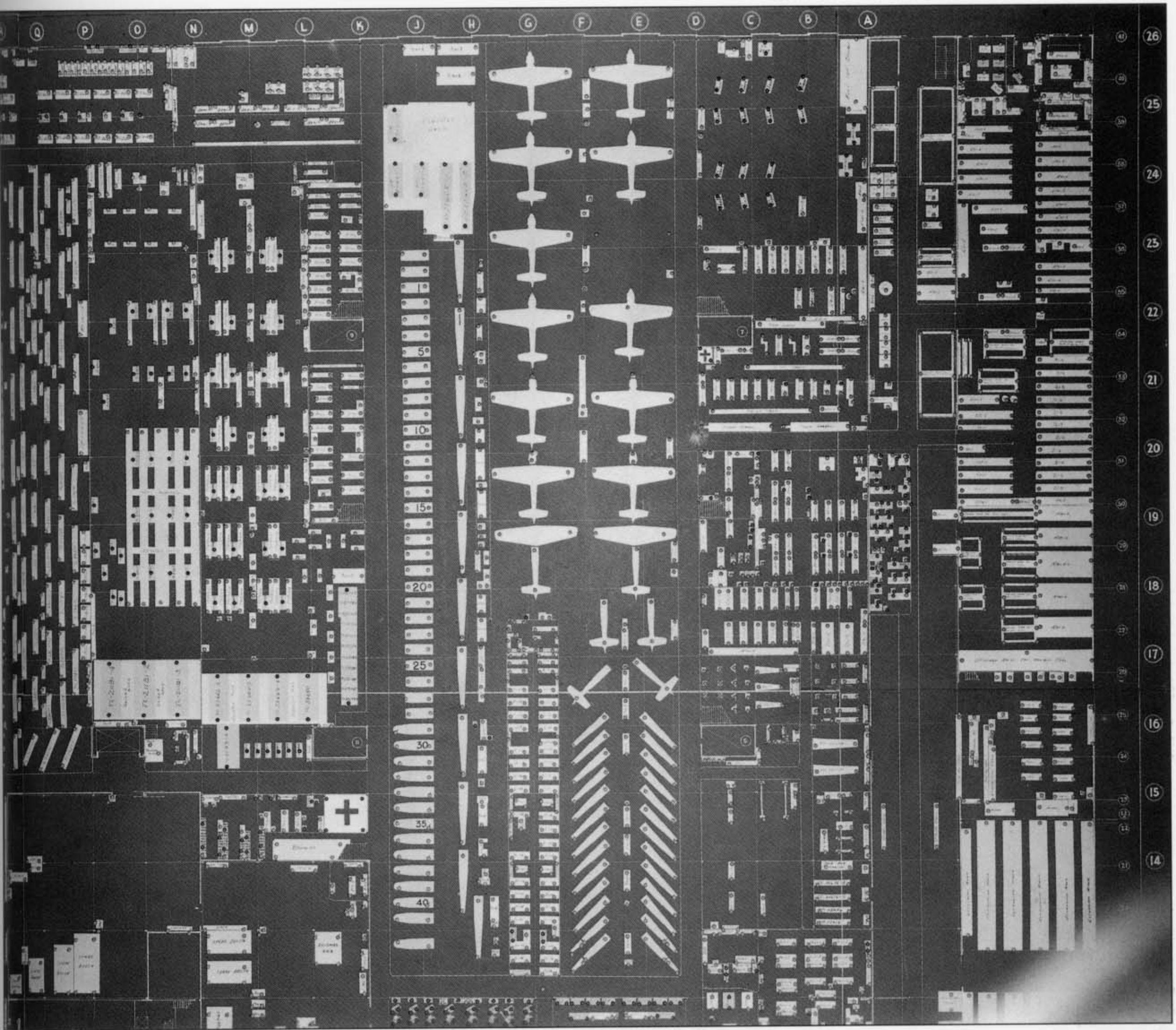
Although Hitchcock's feelings were well-placed, he did not know that work was going on to make the Merlin Mustang a

BELOW Photographed outside the assembly hangar under the camouflage netting, this view of a P-51B wing shows the large stress doors to advantage. Made of Alclad 24S-T aluminium, the stress doors offered access to the wing fuel tanks, while also forming an essential part of the wing's structure. The leading edge of the wing has received its coating of 'dum-dum' filler (a material that was applied to help maintain the desired laminar flow), while a quick coat of primer has been sprayed over the forward portion of the wing. The main landing gear is inside the wing, but the gear doors have not been attached. Early phenolic resin external stores pylons are in position. The long pipe running down the centre of the wing is the engine compartment scupper drain which, when completely assembled, would drain out of the left side of the scoop. The scupper was in place to drain anything leaking from the engine compartment. NAA employee George Wing invented an extra hard rivet for use during the construction of the laminar flow wing. When utilised in the wing structure, it replaced nearly 800 rivets and bolts, giving a 60 per cent weight saving, while also increasing shear strength by 200 per cent. Wing would go on to found his own company, producing aviation components and even an unusual two-seat twin-engined private aircraft called the Wing Derringer



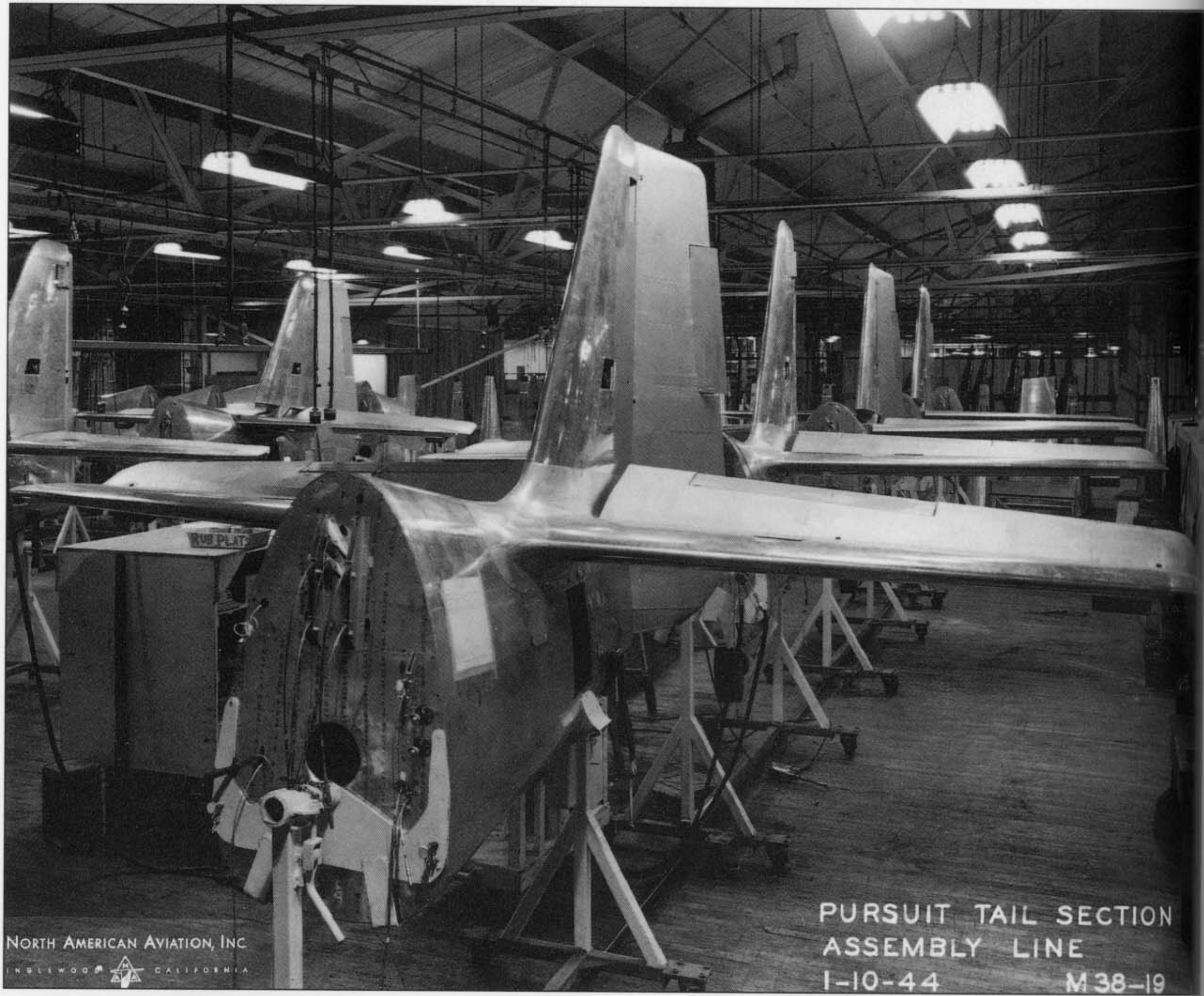
reality. Hap Arnold had seen the potential in the design and Brig Gen Oliver Echols, Arnold's Chief, Materiel Division, was instructed to get the concept into reality. From 1940 onwards, Echols had been responsible for setting up the license-built Packard Merlin production line, and he quietly made sure that two new V-1650-3s were transferred to North American for the XP-78 project (the Merlin Mustang had been given this new designation, but it was to be short-lived).

In Britain, Mustang AM121 was sent to Hucknall on 7 June 1942 to form the basis for the first conversion. The aircraft was followed by AL963, AL975, AM203 and AM208 (the last two were added to the Rolls-Royce programme by the request of the USAAF). Some initial flying was done with AM121 in its stock condition to obtain performance data. At an early stage in the conversion it was decided to use the Merlin 65 instead of the Merlin 61, and the first aircraft made ready for flight was AL975/G, which flew on 13 October 1942. Back in Inglewood,

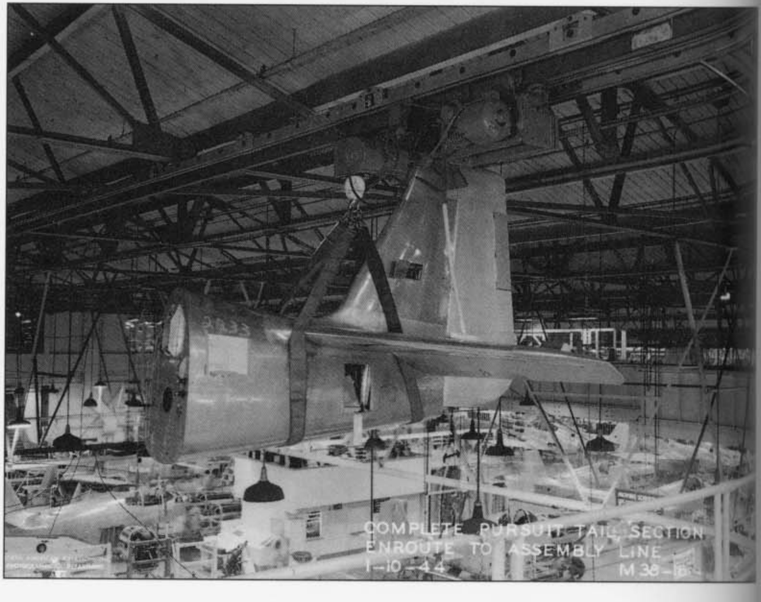


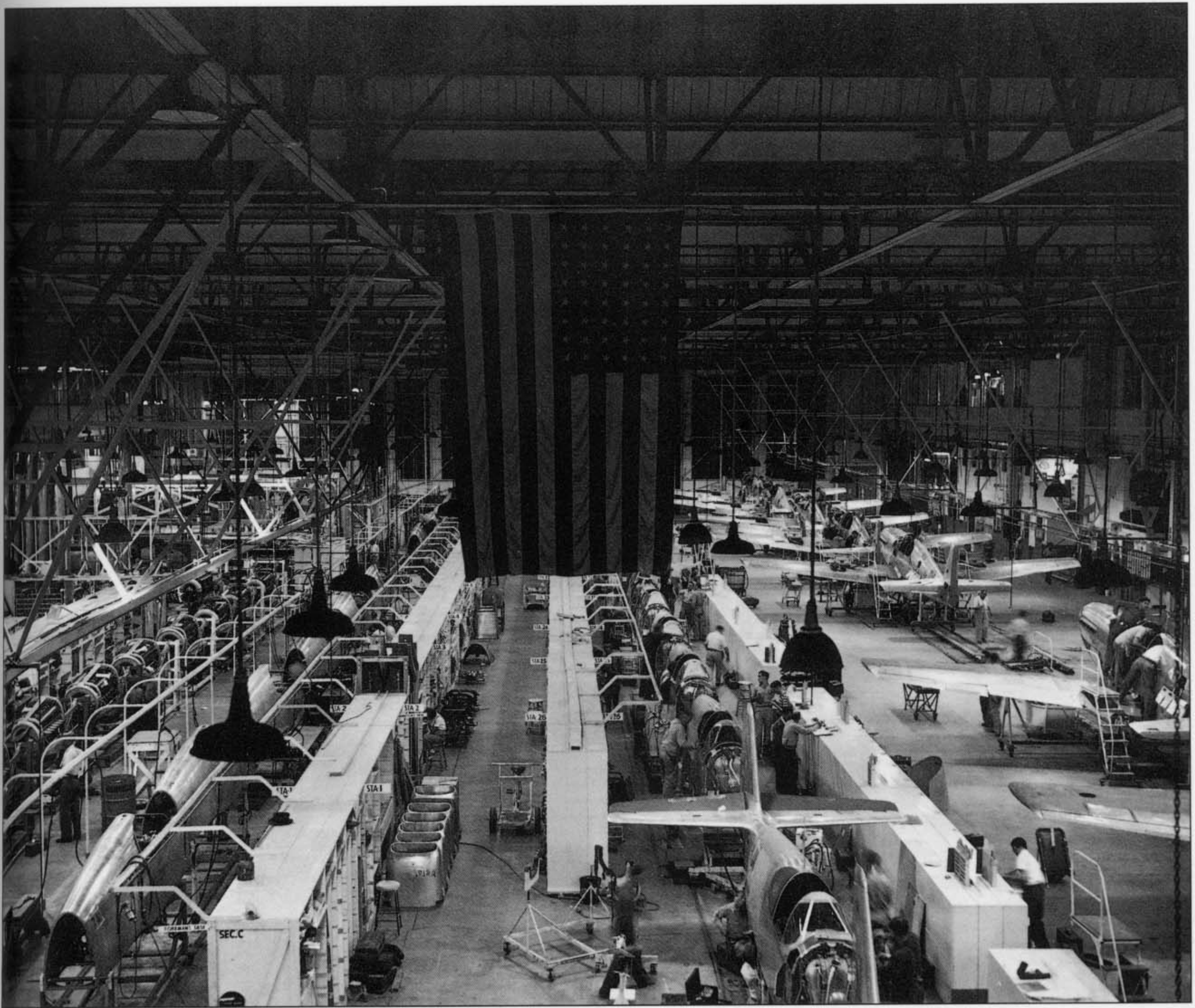
LEFT A batch of early B-models comes together in the Inglewood plant. It is interesting to note how American aircraft manufacturers picked up on the mass production techniques created by Henry Ford for his automotive empire. Close examination of the photograph show how various components were added in a logical order as the aircraft progressed down long lines before making a tight U-turn and heading down another long stretch, all the time being pulled by an electric hoist. At the extreme left background, Packard Merlins were placed in engine mounts, while partial fuselages were assembled. On the next turn, fuselages became more complete, while tail cones and tail surfaces were installed as the fuselage passed out of the left side of the photograph. Taking one more U-turn, the wings and engines were installed, along with many other details including the canopy structure and plexiglass (which still wore its protective paper coating from the manufacturer). These aircraft were P-51B-5-NAs

ABOVE Factory lay-out illustrating the flow of parts and components into complete P-51B Mustangs


PURSUIT TAIL SECTION
ASSEMBLY LINE
1-10-44
M 38-19
NORTH AMERICAN AVIATION, INC
INGLEWOOD CALIFORNIA
RUB PLATE

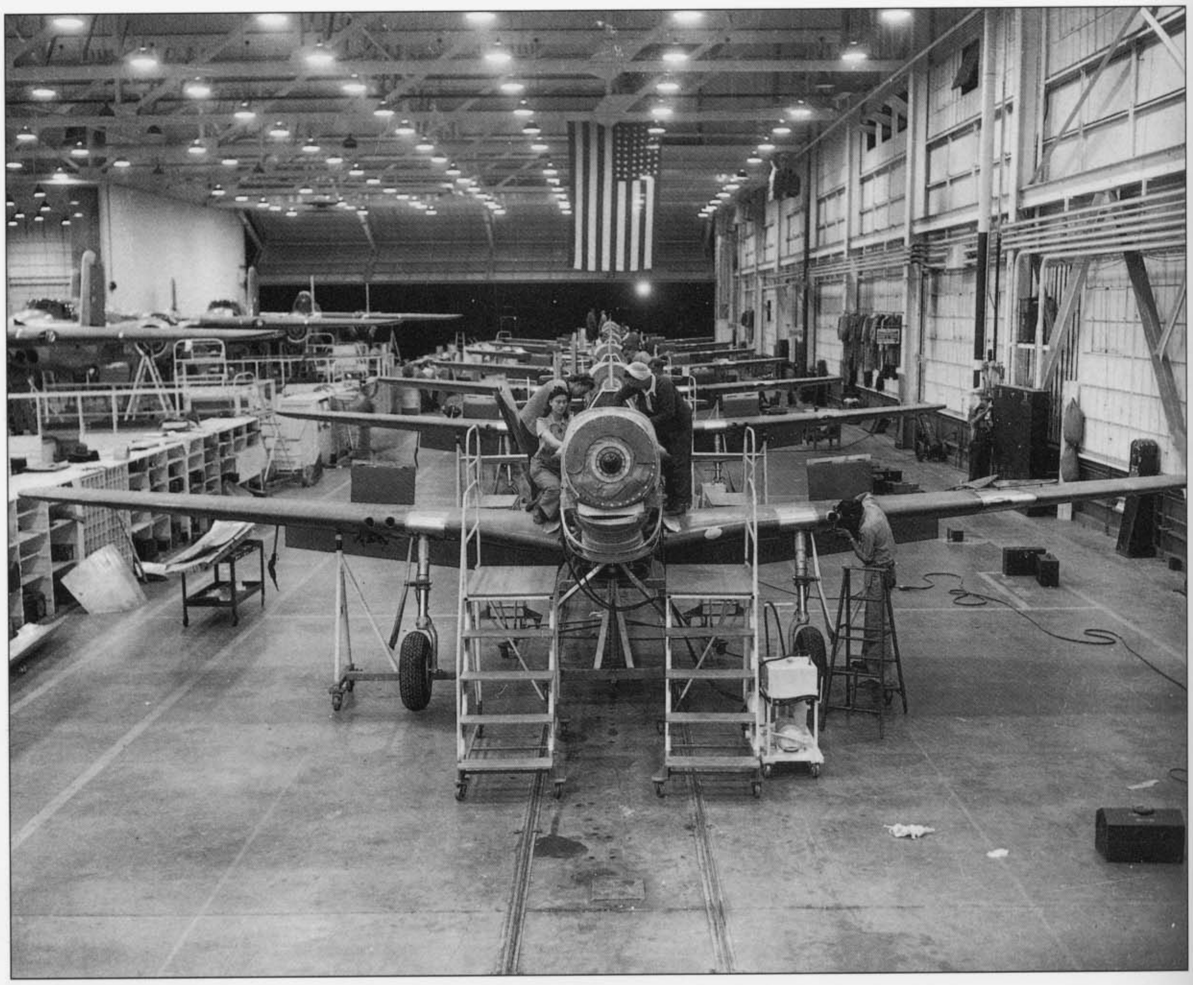
ABOVE Nearly complete P-51B tail cones and tail surfaces in their jigs awaiting transfer to the assembly line on 10 January 1944


COMPLETE PURSUIT TAIL SECTION
ENROUTE TO ASSEMBLY LINE
1-10-44
M 38-18



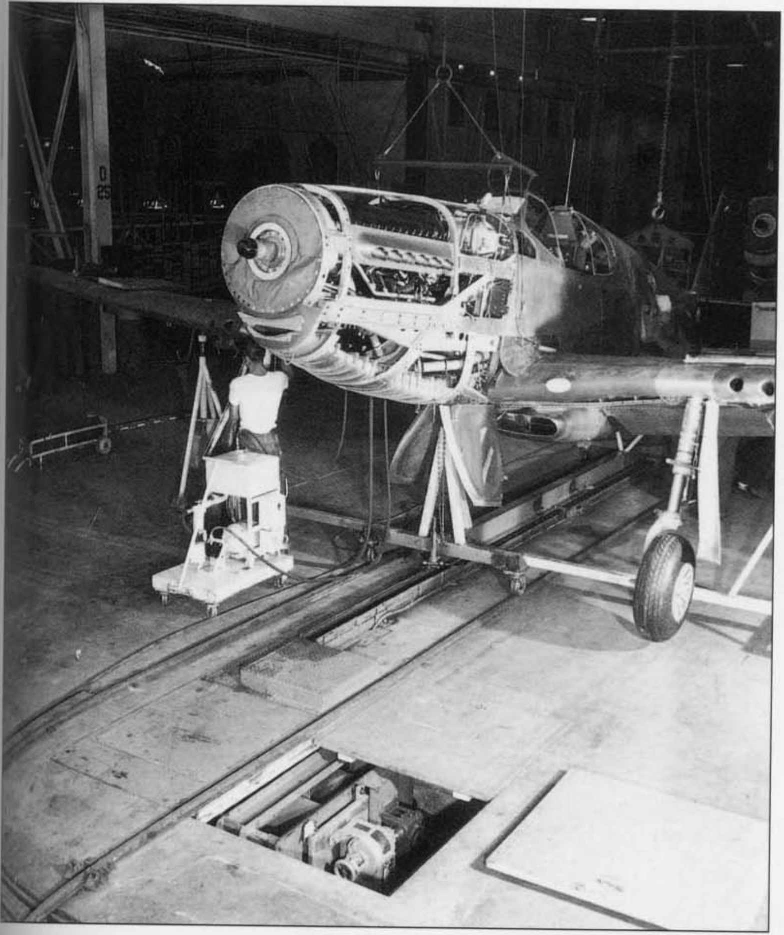
LEFT Electric overhead hoists were utilised to move the tail sections to the assembly line. Once the P-51Bs entered combat, Base Air Depot Areas in the United Kingdom were set up to correct faults found in the B-model after its initial combat experiences. These faults were either rectified in the field or incorporated in the NAA production lines. One fix was the reinforcement of the horizontal stabiliser after it was discovered that at high speeds or whilst being handled carelessly (or enthusiastically), Merlin-powered Mustangs exhibited a previously unseen weakness in the tail, which showed up as bent metal or, in the worst instance, complete structural failure. A doubler plate was produced for reinforcement of the horizontal tail spar until a strengthened component could be incorporated into the production line

ABOVE Another view of the P-51B production line. Under a large American flag, the V-1650-3 powerplants can be seen to the left and the very basic fuselages starting their journey at Station 1 immediately alongside. The latter then moved up and down the rows where, at each station, specific components and equipment was added. Piles of parts can be seen at each station including seats, scoops, cowlings, etc. These supplies were replenished during the day by constant deliveries from the parts depot



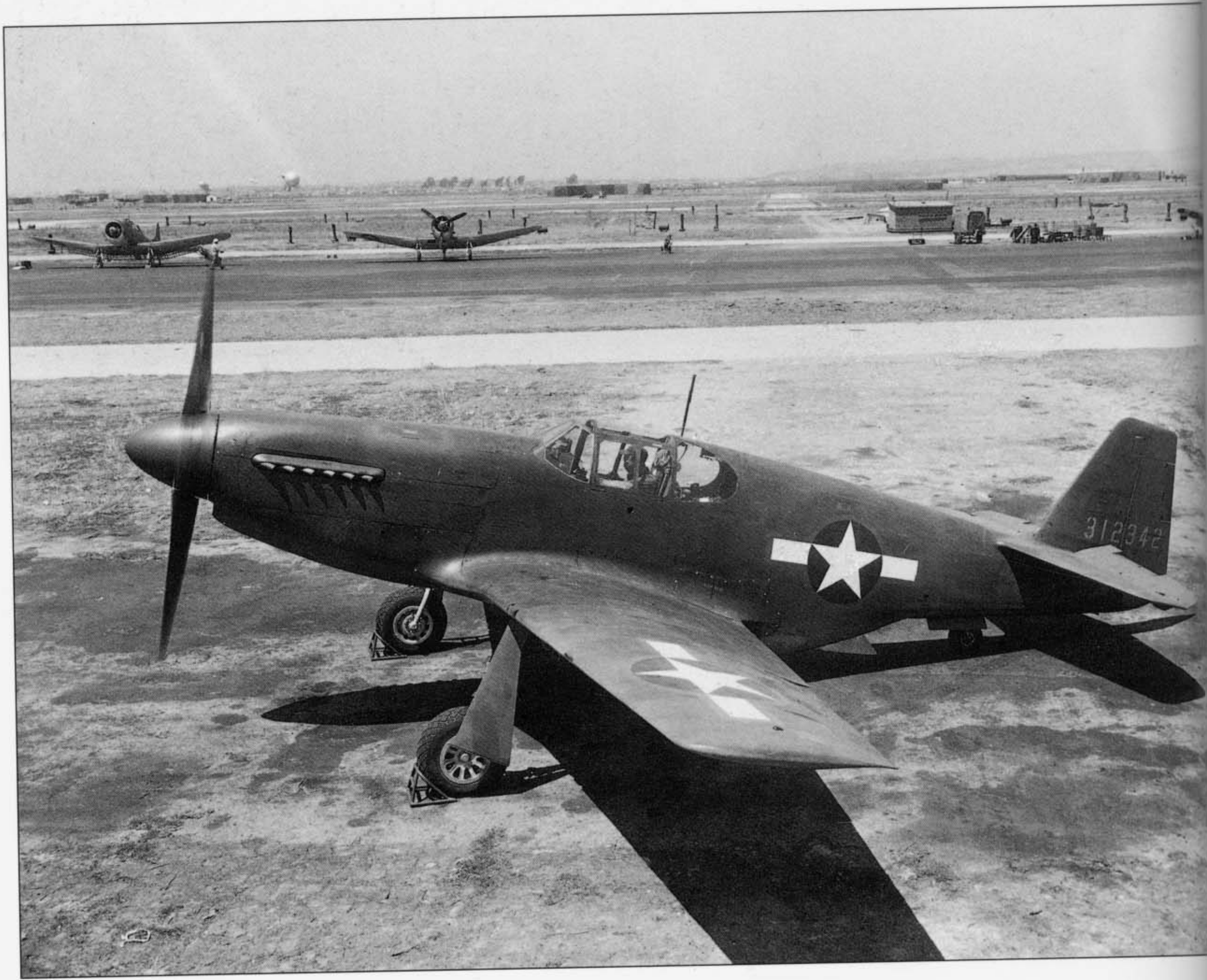
ABOVE B-model Mustangs head toward completion. The dolly which moved each aircraft through assembly is clearly visible. As can be seen, various wing access panels were not in place when the wing received its coat of primer. One worker is hammering sheet metal around a left wing gun port, while three colleagues are finishing cockpit installations. Along the wall, workers' clothing is on hangars that were lifted high from the shop floor, apparently as a fire prevention aid. The armour plate around the header tank and canvas fitting over the nose gear case are also installed. Note B-25 Mitchells also nearing completion on the left side of the photo

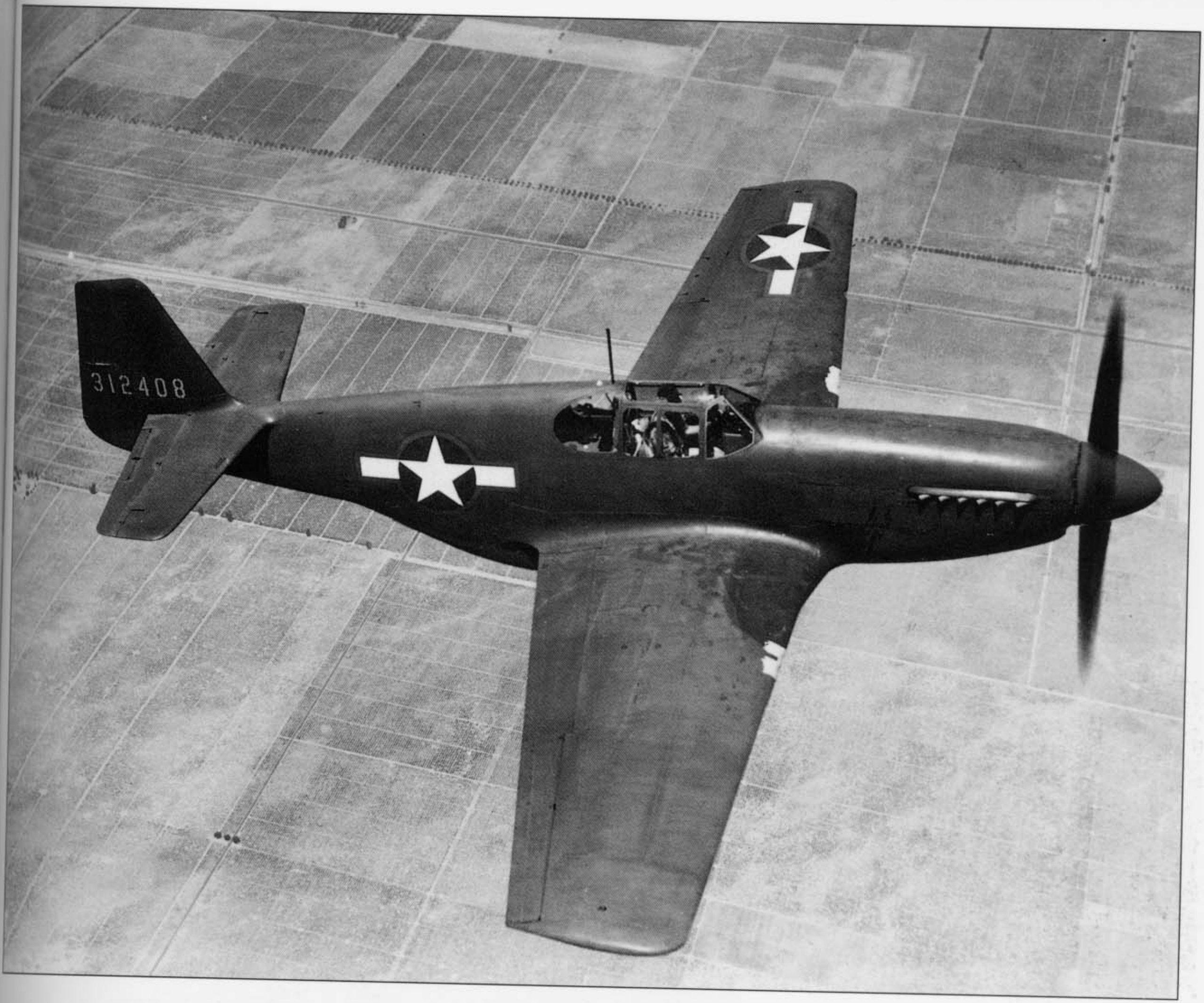
RIGHT Up on jacks, an early model P-51B undergoes gear swing tests, with power being provided by a hydraulic 'mule' located under the propeller. The canopy has been removed and placed on the wing. Workers found that conducting such work under the camouflage netting was preferable since it helped diffuse the hot sun or bad weather



BELOW A Mustang is removed from its dolly. This particular aircraft has had the cowlings taken off. General Tires featured the diamond tread common to the tyres on many World War 2 combat aircraft – it was felt that this type of tread was better suited to grass fields or unprepared runways. General, Firestone and Goodyear all supplied tyres for the Mustang production line

BELOW Firmly chocked, P-51B-1-NA USAAF s/n 43-12342 is run up by a mechanic prior to a test flight. Douglas SBD Dauntlesses can be seen being prepared for a similar task in the background. The aircraft carries the short-lived red surround to the national insignia, and although just out of the factory, the P-51B's flat Olive Drab and Neutral Grey camouflage already show considerable wear just from use around the factory. The serial number was painted on the vertical tail in Insignia Yellow. USAAF orders led to some confusion on how such a number, or 'radio call sign', should be presented. On 13 January 1943, Spec. 98-24105-Q, Amendment No 2, Paragraph E-6A read, 'Each airplane shall have a radio call number painted on its vertical tail surfaces. The radio call number shall consist of at least four numerals and shall be determined in the following manner: The first number and the hyphen shall be omitted from the serial number of the airplane, using zero where necessary between the year designated and the serial number to make at least four numerals'. The document continued, 'For light coloured backgrounds, the numbers shall be black in accordance with colour chip No 44 of Army Air Forces Bulletin No 41, and for dark backgrounds, the numbers shall be yellow in accordance with colour chip No 48 of Army Air Forces Bulletin No 41'. Even though this clarified the situation, mistakes were still made at various factories and especially in the field when the aircraft was repainted



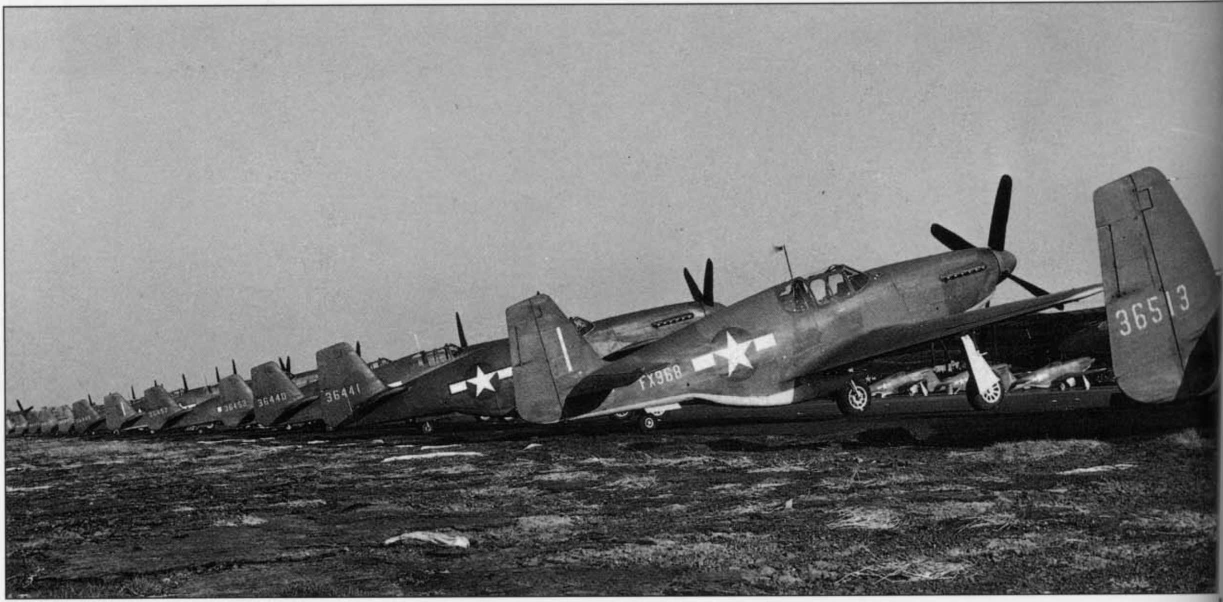


test pilot Bob Chilton took the first NAA Merlin-powered P-51A conversion, USAAF s/n 41-37352, aloft on 30 November 1942, so it was a close thing as to which country took the honour of flying the first Merlin Mustang. Actually, NAA and Rolls-Royce freely exchanged data as the conversions went along.

Lt Col Cass Hough had seen the potential of the Merlin Mustang from the start, and as a technical officers at HQ VIIIth Fighter Command, he kept in close touch with Rolls-Royce liaison officer William Lappin, who eventually invited Hough to Hucknall to fly one of the new aircraft. 'I just assumed it would be a conventional airplane because nobody told me anything. The only information I got from Bill Lappin was that the first flights that had been made up at Hucknall resulted in the pilots being just delighted with the airplane.

'Flying a new airplane, I always put the power on easily at the start to get the feel of the airplane on the ground, then gradually give it power. When I got airborne, a couple of hundred feet off the ground, I pulled up the gear and decided then I'd see how it would climb from scratch. I poured the coal to it and the

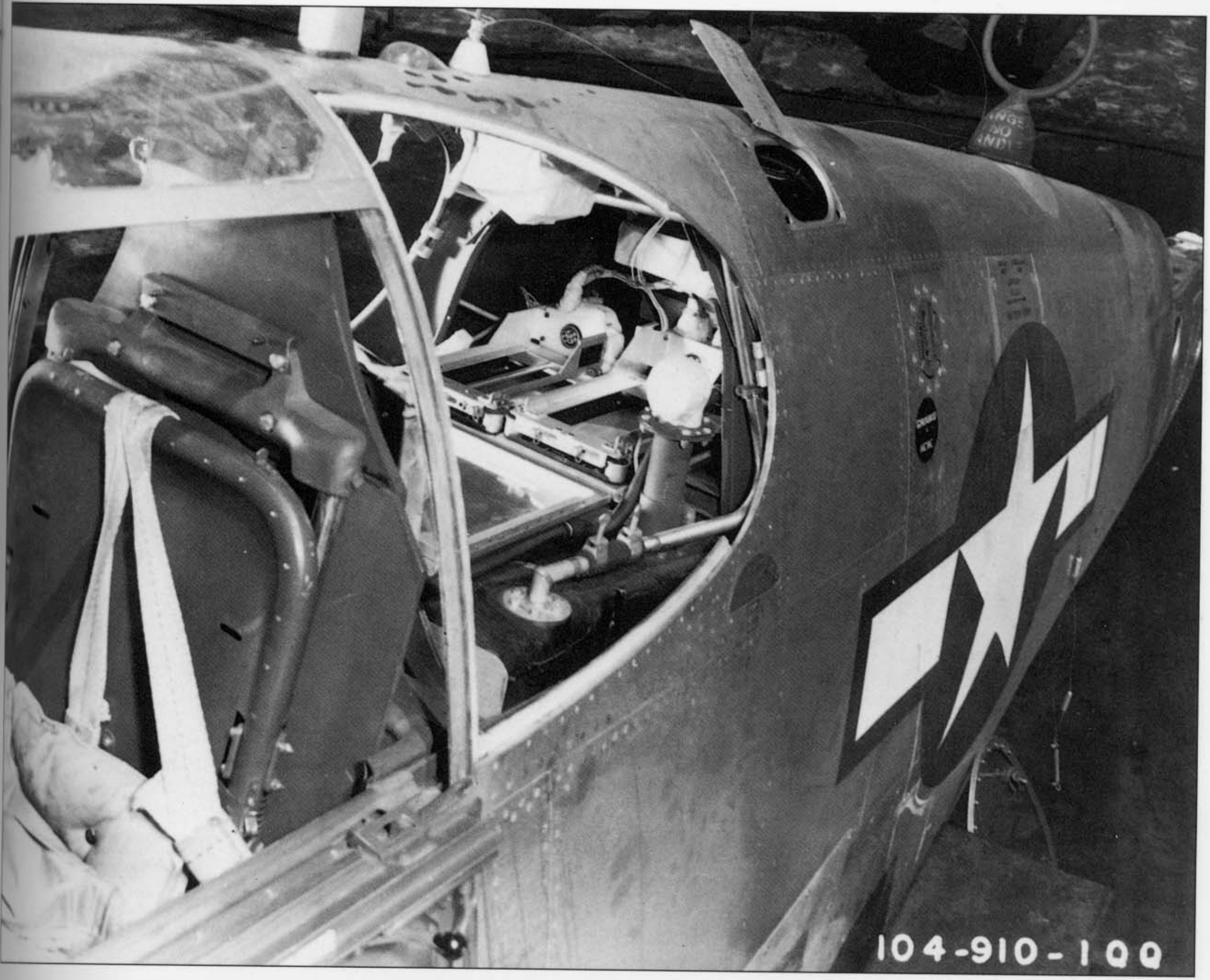
High-angle view of P-51B-1-NA USAAF s/n 43-12408 displays the Mustang's broad and simple wing structure to advantage The square wing tips bore some similarity to those of the Luftwaffe's Bf 109, and when the Mustang entered combat, distinguishing wing bands were required to hopefully prevent accidental firings on the fighter. The easy staining of the camouflage paint is readily visible, as are the taped-over gun ports for the four .50 cal Brownings



ABOVE Rows of Mustangs (for both the USAAF and RAF) indicate the rapid build-up of production at NAA. In RAF service, the aircraft was designated the Mustang III, and even though they were finished in full grey/green camouflage, they carried USAAF insignia on their fuselage sides prior to delivery. The closest Mustang III to the camera is FX968, which served with the RAF until being struck off charge on 24 July 1944

OPPOSITE TOP Detail view of the rear cockpit area of a P-51B-7-NA that has had the rear quarter panel plexiglass removed to display the battery holder and racks for the radio transmitter and receiver (both units of which were removed from the aircraft). The large black rubber 85 gallon fuselage tank is also visible, along with its vent tube. The new tank was introduced on the P-51B production line, and numerous earlier examples were retrofitted with the unit. Made of the same self-sealing rubber material as the wing tanks, pilots had to carefully monitor the tank, for when full, it placed the centre of gravity at its aft limit. Accordingly, fuselage tank fuel was utilised from the start of a mission, and manoeuvring was restricted until less than 25 gallons remained. However, the fuselage tank greatly increased the range of the P-51B/C. The ADF loop can be seen on the rear fuselage, while the upper recognition beacon is fitted directly above the rear view glazing. The open access panels allowed work to be carried out on the electrical systems. The hand hold for the pilot is also visible in this view, as is the black 'ground here' circle which was utilised when the aircraft was being fuelled. The gauge for the fuselage fuel tank (on a mounting above the vent tube) has been taped over to avoid damage while equipment was installed or removed

OPPOSITE BELOW Over a snow-crusted section of the San Gabriel Mountains, test pilot Bob Chilton looks upward at the photographer in the B-25 Mitchell camera aircraft. The high angle view of the Mustang emphasises how some pilots or anti-aircraft crews could mistake the P-51B/C for the mitt Bf 109. This particular aircraft is carrying two 65 gallon jettisonable fuel tanks on the underwing pylons. Fuel gauges were not provided for the external tanks, and the pilot was required to rotate the fuel selector valve approximately every 15 minutes in order to keep the aircraft in trim. Prior to dropping the tanks, the pilot had to select an internal tank or the Merlin would falter as the fuel supply rapidly depleted. No boost pumps were provided for the drop tanks, and fuel was forced out of them by a pressure of five PSI from the exhaust side of the vacuum pump. If this system failed, the engine-driven fuel pump could draw fuel from the tanks up to an altitude of 10,000 ft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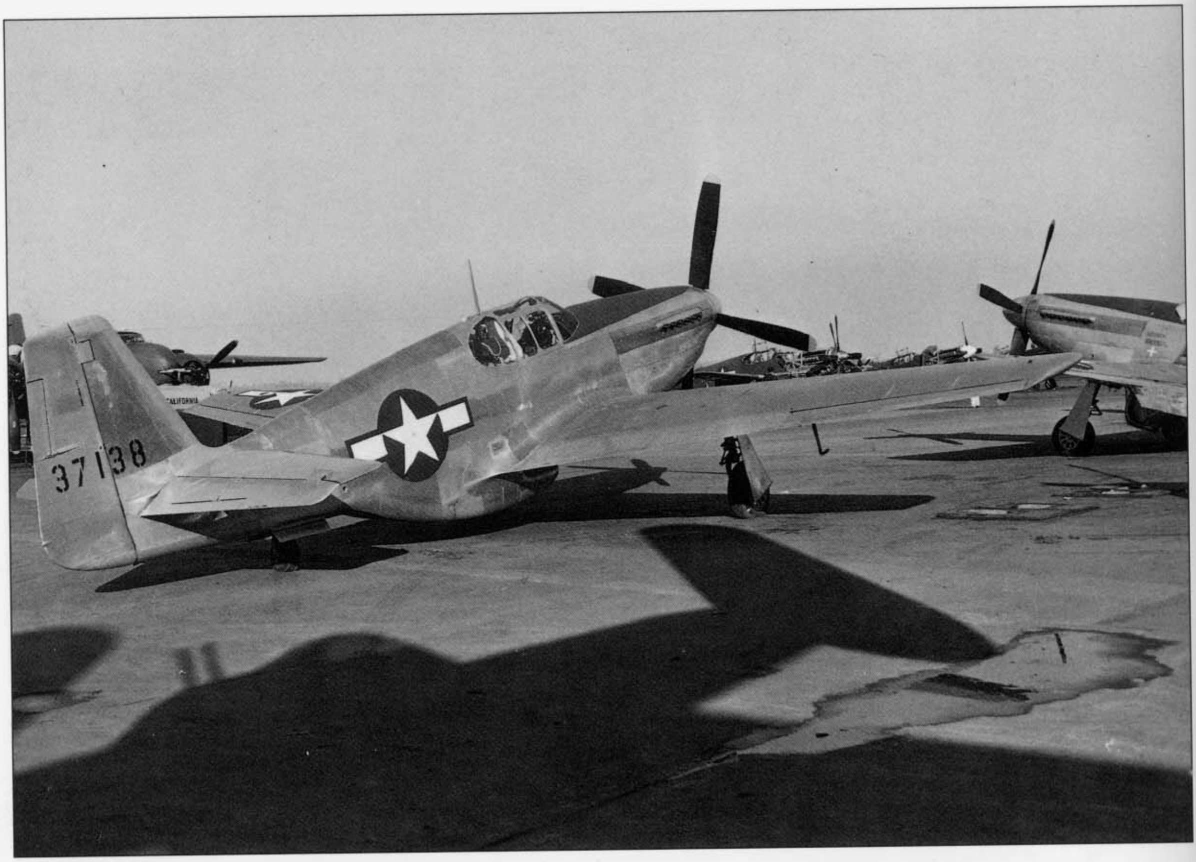
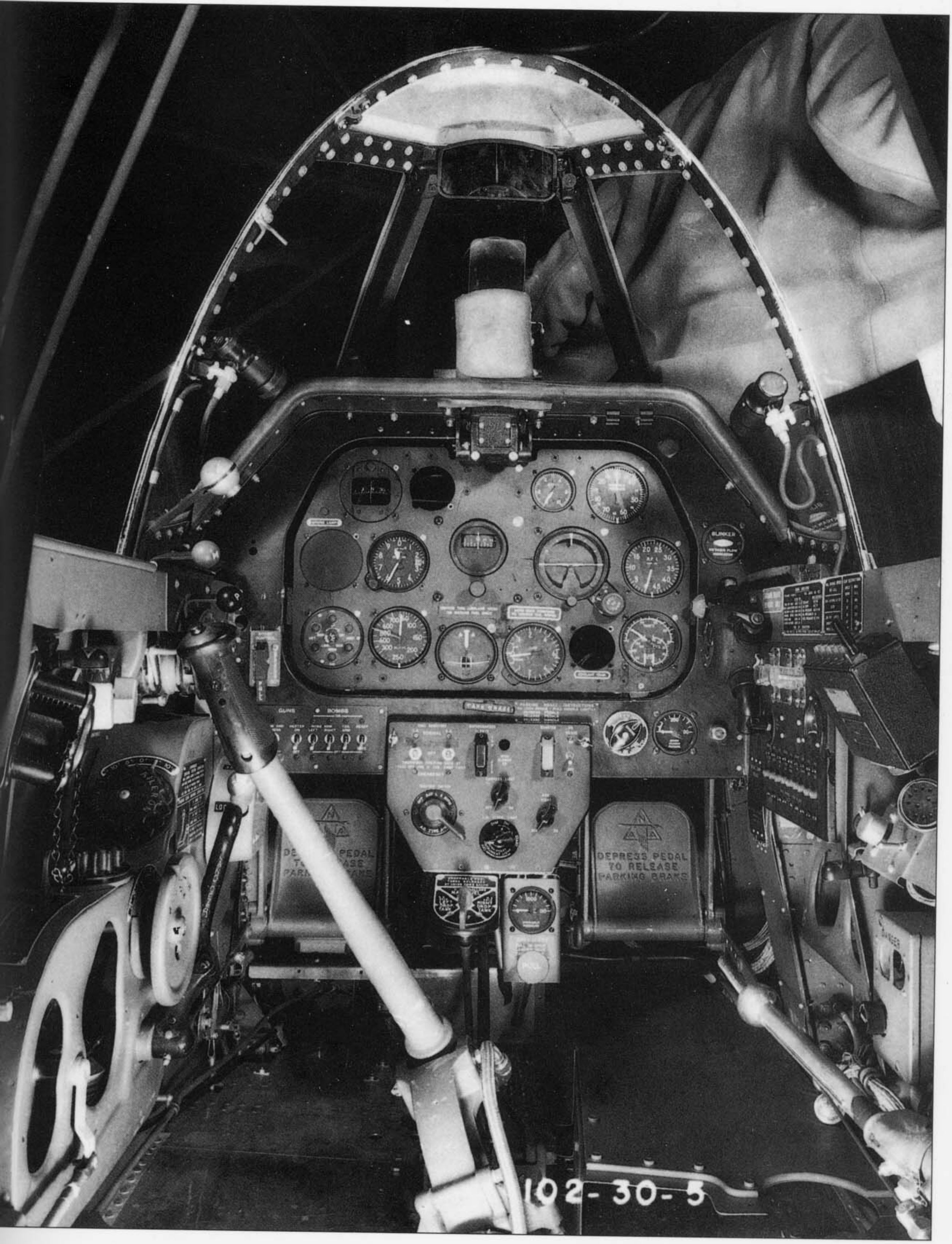


ABOVE Camouflage and bare metal P-51Bs are seen at the NAA plant as new unpainted Mustangs supplement the last camouflaged examples coming off the production line. USAAF s/n 43-7138 is a P-51B-10-NA (398 examples of which were built), whilst the aircraft to the right displays a white cross under the individual aircraft data block. Such a marking alerted groundcrews that the Mustang was fitted with the 85 gallon fuselage tank, which required filling. Regarding the fuselage tank, Louis Wait, NAA administrative test pilot, commented, 'The first objectionable feature was that the weight without external tanks was increased to about 10,000 lbs, which decreased the ultimate pullout factor from an original 12 G down to 9.5 G, but this was not as serious as the fact that when the additional fuel was added, the airplane's centre of gravity was placed so far aft that the it became longitudinally unstable. This instability was particularly dangerous in that a pullout at high speed was always accompanied by a stick force reversal which, unless opposed by the pilot, would quickly carry the airplane into an accelerated condition where the wings would fail at the inboard end of the gun bay"

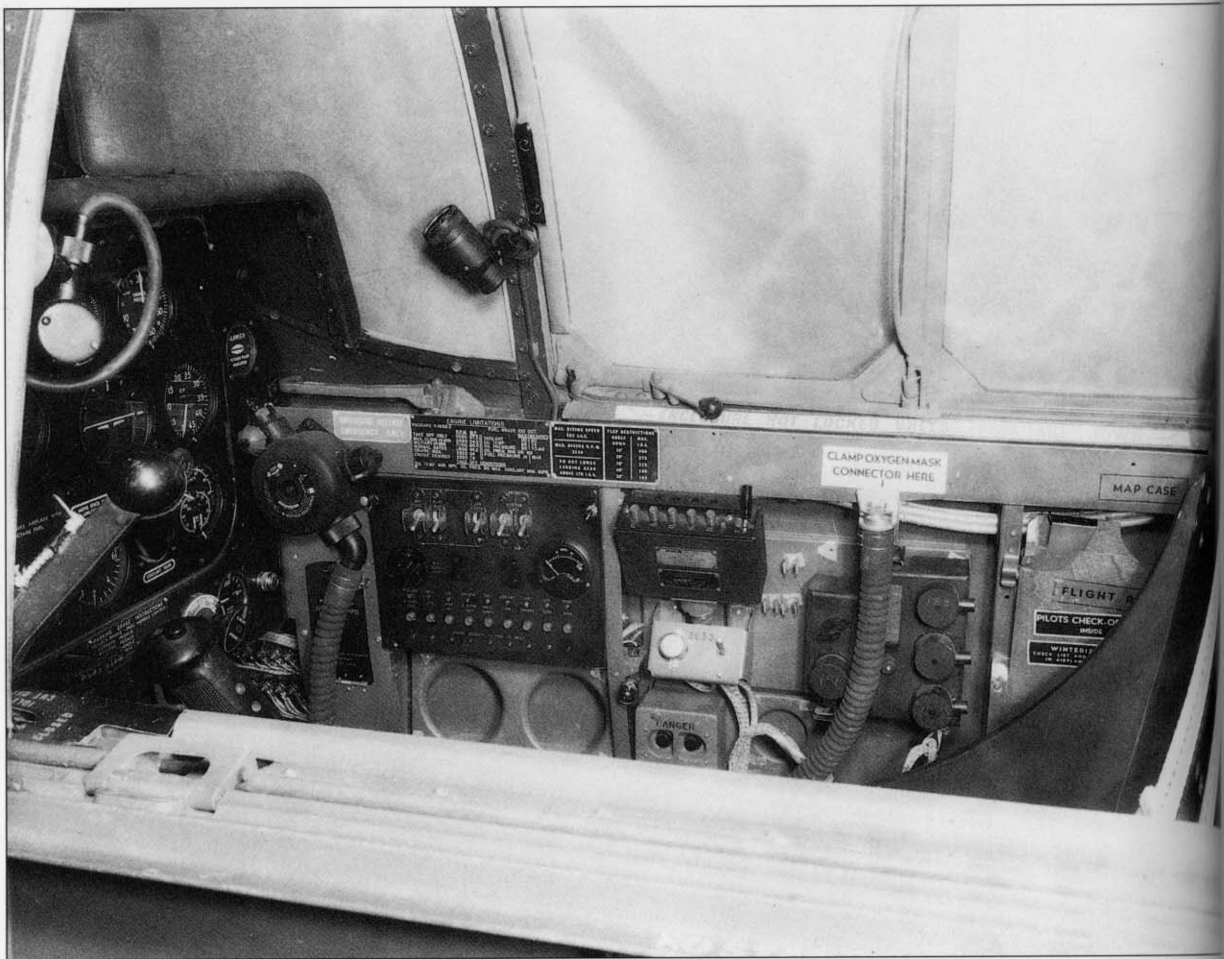
RIGHT Nearly fully equipped P-51B cockpit. Items of note include rear view mirror mounted on the upper portion of the windshield, a crash pad atop the instrument panel shroud, and basic flight instruments arranged in the central panel. The devices mounted to the lower right and left windshields are moveable fluorescent lights


DEPRESS PEDAL TO RELEASE PARKING BRAKE
102-30-5

aircraft snap rolled! Rolls-Royce hadn't provided enough vertical fin area, and not enough offset.

'I was eager to get it to altitude and see how it performed because that was the critical thing. I studied the fuel curves of the Merlin in several other airframes so I knew what the range of the airplane would be on internal fuel, but I didn't now how the airplane would actually handle at high-altitude because no one had ever got an Allison Mustang above 24,000 or 25,000 ft. Ordinarily, the two-stage blowers – the early ones – were manually operated on the Spitfires. I had just begun to think it was time to change blowers – I hadn't even inquired where the handle was for changing it – when, all of a sudden, I got this big "chug" and a thump around 16,000 ft and of course it was then in high blower. There was an automatic supercharger gear change and it was a complete surprise.

'I got up to about 33,000 ft with it and it was so manoeuvrable, and I could tell without making any speed runs, assuming the airspeed indicator was calibrated reasonably carefully, that it was performing wonderfully. I just couldn't believe some of the things I saw after doing a couple of speed runs with it.'

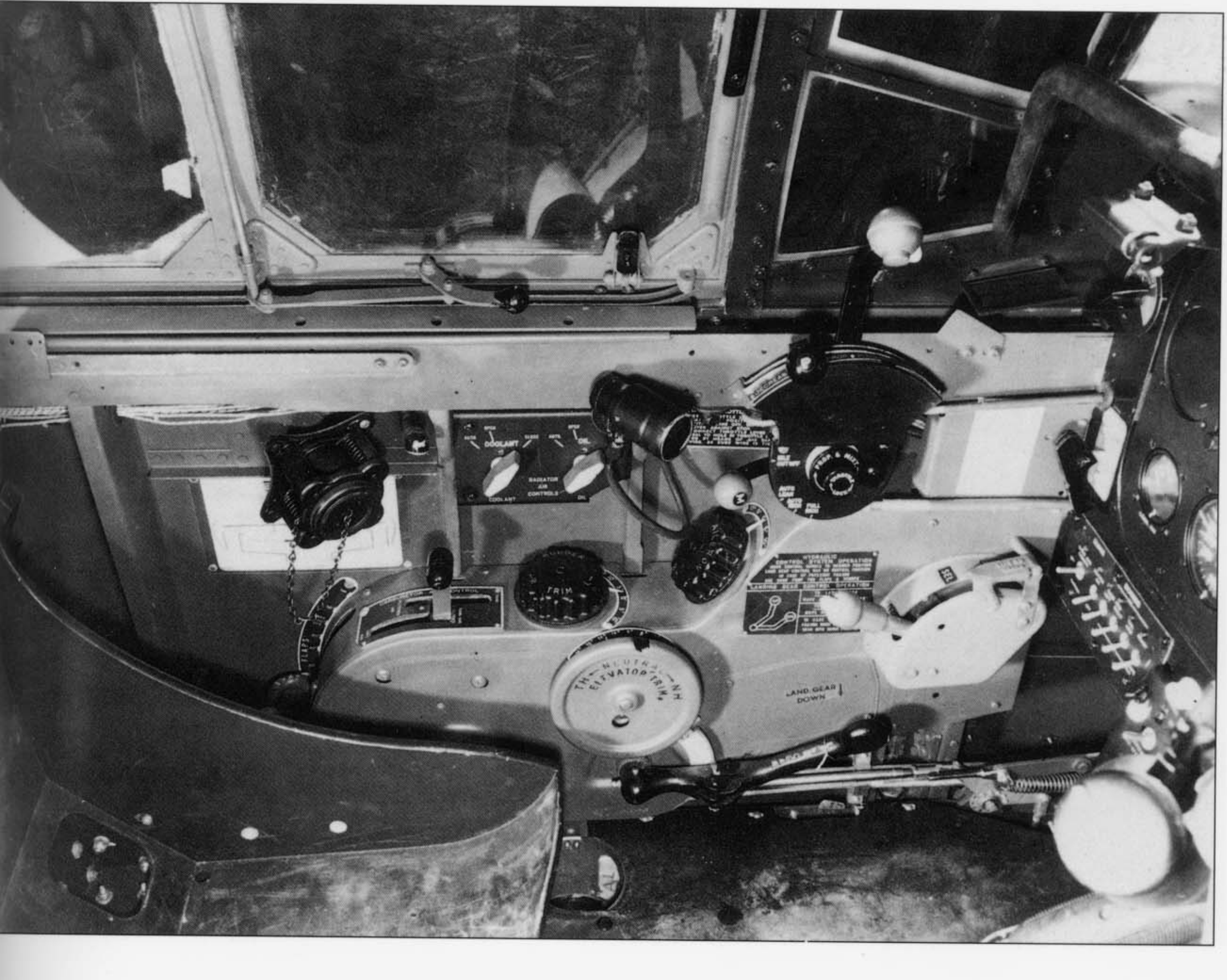


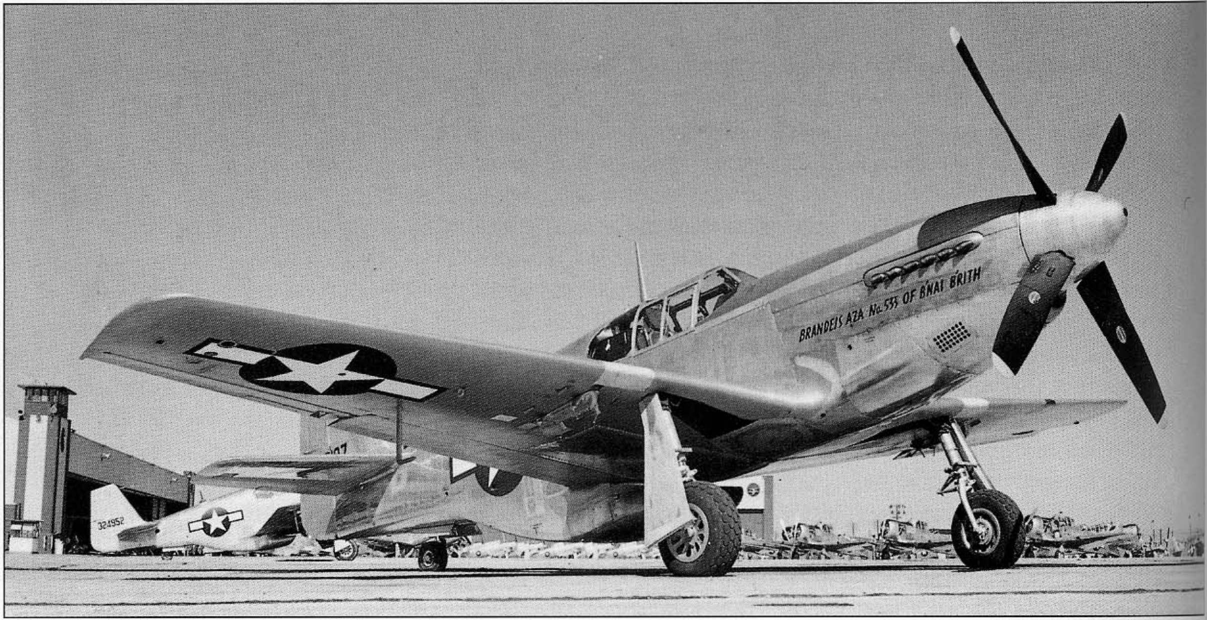
With its windows covered over to prevent reflection, the right side of a P-51B cockpit is illustrated showing such details as the aircraft operating restrictions plate, SCR522 and SCR535 radio control boxes

It should be noted that the supercharger had the ability to maintain sea level atmosphere from the induction system to the cylinders, which allowed the Merlin to produce more horsepower at 26,000 ft than the Allison could during a full power take-off.

The Mustang Xs were rather crude looking aircraft with ungainly cowlings and cooling systems, but the XP-78 was a much more elegant package. However, they were also not without trouble. Using the lessons they had learned with the earlier scoops, NAA engineers created a new coolant radiator and scoop design that was successfully mated to the aircraft. However, the first engine runs on the development aircraft came to a quick end when temperatures rocketed into the red. This was caused by ethylene glycol loosening residue in the cooling tubes and clogging the new aluminum radiator, which had been designed to be of less weight in order to avoid strengthening the mounting area. When Chilton took the first aircraft up, he was very pleased that the Merlin was exceeding performance specifications, but after approximately 45 minutes the engine overheated and he had to make a quick landing with the Mustang

Left side of a P-51B cockpit, showing the throttle and mixture control, bomb control and anti-salvo guard, landing gear handle and rudder, elevator and aileron trim tab controls





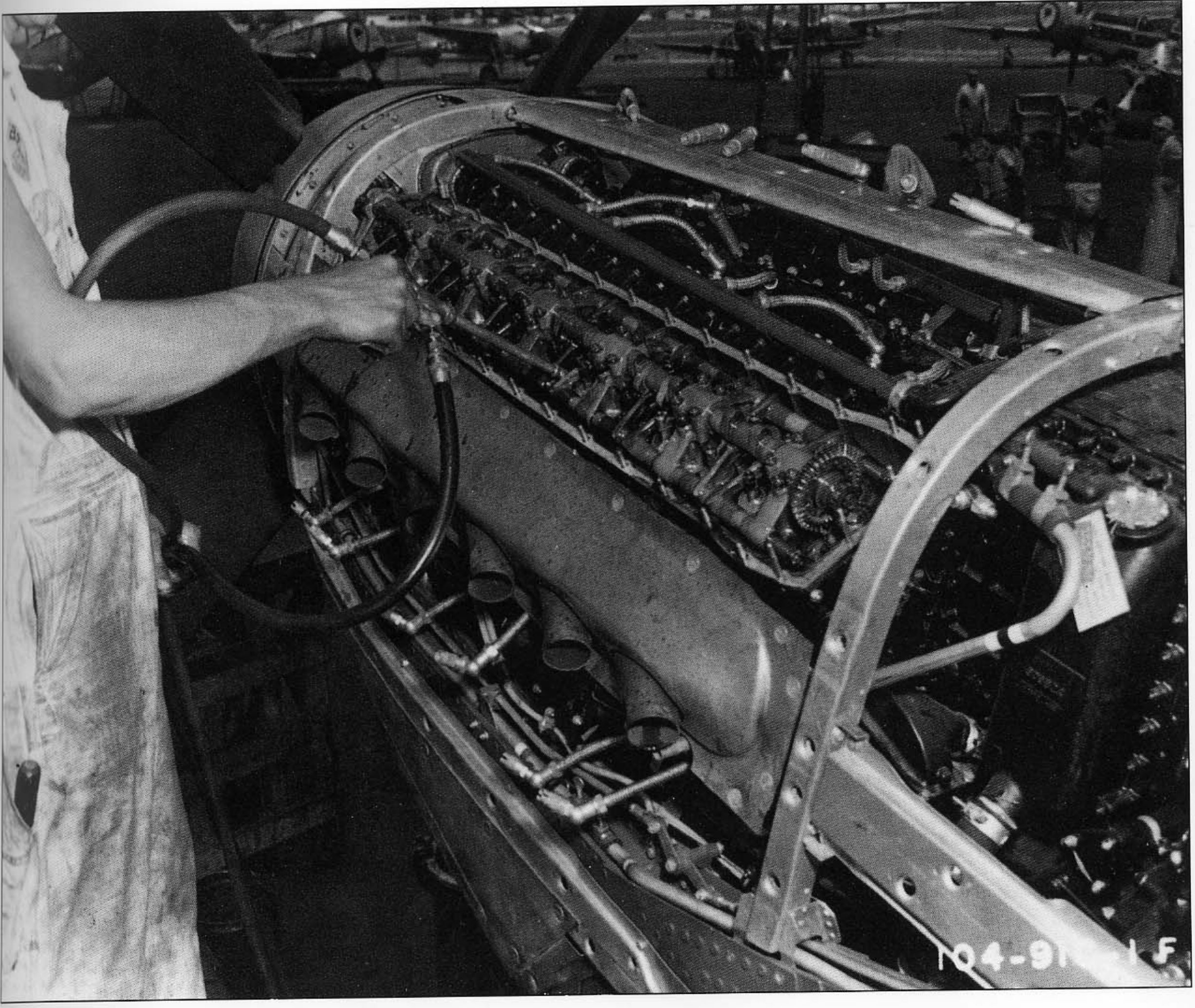
ABOVE North American Aviation opened a new plant in Dallas, Texas, to facilitate increased Mustang production (along with other types of aircraft, including the Texans seen in the background). The first Mustangs built at Dallas were designated P-51C-1-NTs and were virtually identical to the B-models – the Dallas facility would produce a total of 1750 P-51Cs. This particular P-51C-10-NT is a 'presentation' machine – an aircraft which had been 'bought' by donations from individuals, companies or civic organisations – in this case Brandeis Aza No. 533 B'nai B'rith. Factories usually made quite a deal over these aircraft since they served as excellent morale boosters. This view shows the filled and painted wing to advantage, as well as the three coloured identification lights mounted under the right outer wing panel. Natural metal Mustangs had become the norm following a major revision of Technical Order (TO) 07-1-1 issued on 26 December 1943, which stated that the exterior painting of USAAF aircraft was to be discontinued (except for aircraft being supplied to Allies by the USAAF): 'Painting of the exterior metal surface of Army Air Forces aircraft is hereby discontinued. This does not, however, eliminate the required identification data, insignia, anti-glare coatings and corrosion prevention. Man-hours expended on maintaining existing camouflage finishes, now considered unnecessary, will be held to a minimum.'

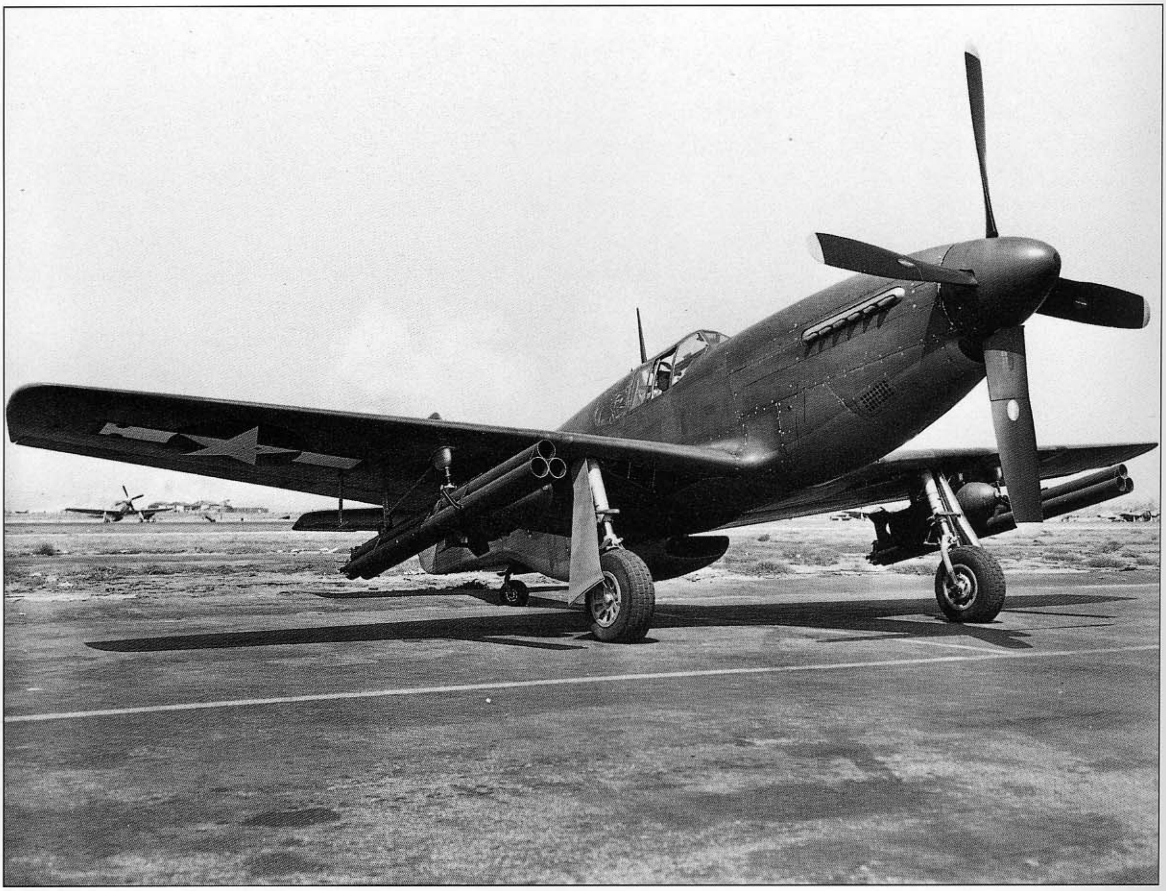
RIGHT Packard V-1650-3 Merlin, with rocker covers removed, receives a spraying of preservative material prior to sea shipment to Great Britain. In the background can be seen Thunderbolts, Lightnings, and an A-36 also being prepared for ocean voyages. The large capped tank to the right of the photograph is the aftercooler filler tank. During August 1940, dialog was started between the American and British governments in order to forge an agreement for license production of the Rolls-Royce Merlin by the Packard Motor Car Company. An agreement was reached in short order, and Rolls-Royce shipped over 2000 drawings to Packard the next month. Three buildings were acquired for engine production, and a team of over 300 engineers was assigned to set up the Merlin for American production. The British metric system was retained, as it would have been too much work to convert, and the Whitworth thread pitch was utilised on the basic engine while accessories were standard American AN units that could easily be obtained and replaced under combat conditions. The first American production Rolls-Royce was the Merlin 28, which was similar to the unit in the Avro Lancaster bomber and employed a single-stage two speed supercharger. The engine was given the military designation of V-1650, the V denoting the V-12 configuration and the 1650 being the cubic inches (actual cubic inches were 1649 but the figure was rounded up). Each Merlin had over 14,000 parts – more than double the number used in a Packard motor car. The supercharger was the key to the Merlin Mustang's performance, and the addition of a Wright supercharger drive quill to the supercharger created the V-1650-3, which entered production in September 1943. In factory parlance, this became the 'high altitude' Merlin, compared to the V-1650-1 used in the Curtiss P-40F.

trailing a tell-tale white stream. Once again the radiator was clogged, and flight testing came to a halt until the cause of the problem could be found. It was traced to an electrolytic action between the various metals and the coolant, which caused residue to be loosened.

In order to overcome the problem, NAA contracted with the Harrison Division of General Motors, and a new radiator was built that had a frontal area of 2.7 square feet. The scoop section had to be slightly redesigned for the extra weight, but the new radiator had a separate section for supercharger cooling, while the oil cooler was mounted forward of the coolant radiator in its own separate scoop, with its own shutter. Chilton resumed flight testing in December of that year, and was delighted to find the new unit worked perfectly, and that performance was greatly increased over the Allison aircraft.

The NAA conversions involved two P-51s – USAAF s/ns 41-37320/37469 (these aircraft also carried RAF s/ns FD450 and FD519) – which had been transferred to the Merlin Mustang





While P-51B production reached a crescendo, NAA maintained a very active experimental shop that realised new concepts and improvements. This view shows bazooka-style rocket launchers fitted outside of the normal underwing pylons for testing on a P-51B – such modifications were quickly and efficiently undertaken and sent on to flight test. As can be seen, with its four .50 cal Brownings, six rockets and two 500-lb bombs, the aircraft became a potent ground attack weapon

conversion programme. The conversion work on the first aircraft was actually completed in just six weeks, and it was decided to drop the XP-78 designation for the new aircraft and adopt the designation XP-51B (NA-102) instead.

Such was the USAAF's faith in the Merlin Mustang that an order for 400 P-51B-1-NA Mustangs was placed on 26 August 1942 – almost three months before the first flight of the XP-51B. A plan by the RAF to have its earlier Allison Mustangs converted to Merlins was dropped in favour of obtaining new production aircraft.

North American officials seriously considered the implications of mass-producing the new B-model alongside the huge order for 1200 P-51As, and, accordingly, a simple and efficient production line was designed and implemented that could accommodate the delivery of 20 Mustangs per day. However, the superiority of the Merlin P-51B saw the A-model order slashed to just 310 examples, and the assembly line was duly modified to accommodate the mass-production requirements of the Packard Merlin instead.

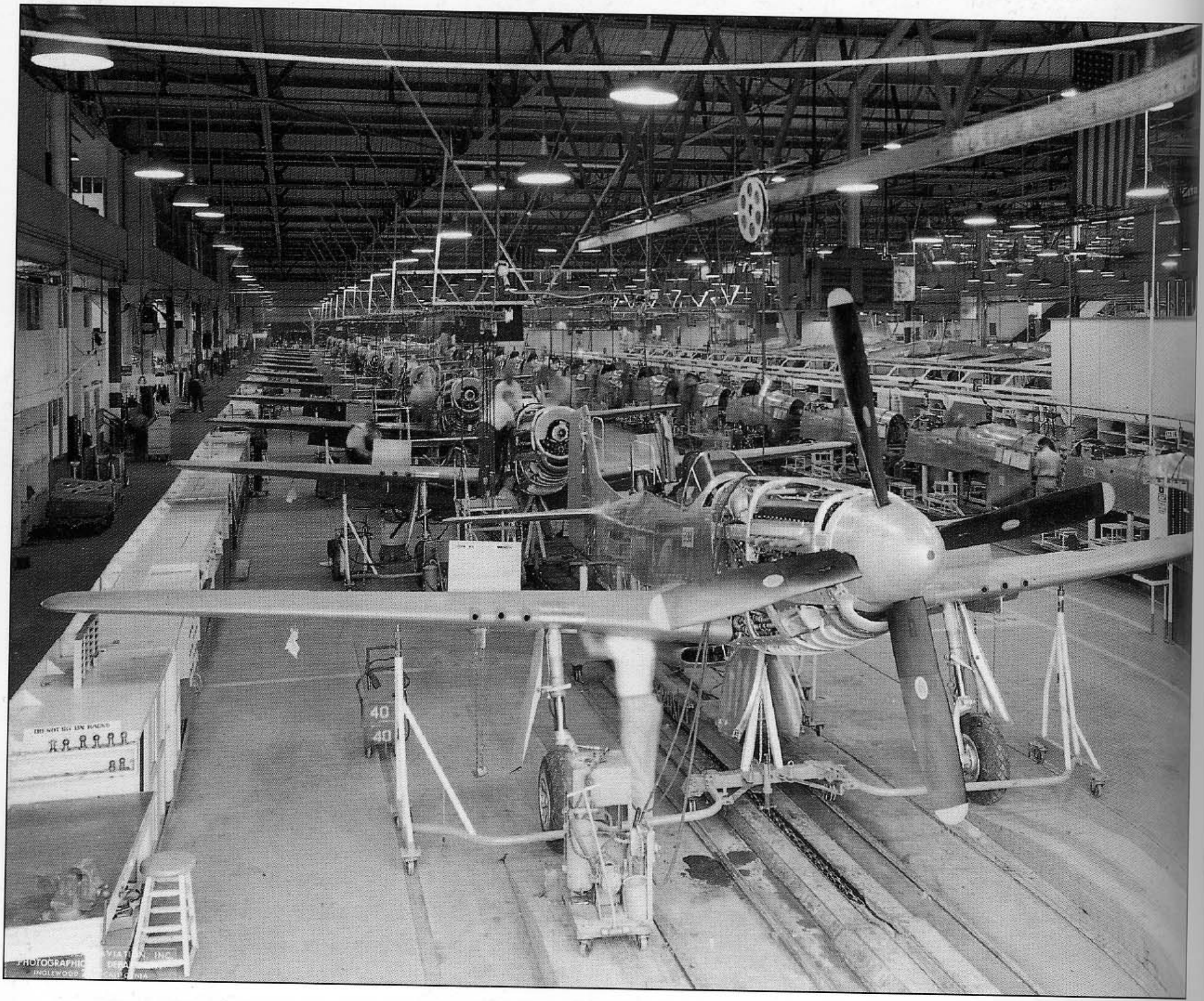
CHAPTER 5

BUBBLE TOP

WITH PRODUCTION IN FULL SWING on the P-51B/C at both both the Inglewood and Dallas plants, constant improvements and modifications were introduced on the production line as reports came back from the combat front. The B/C Mustangs, as well as the majority of Allied and Axis fighters of that period, had canopies constructed from metal-framed plexiglass. While efficient in protecting the pilot from the elements, the metal panels decreased visibility – especially at night or in poor weather – and one of the complaints coming from the frontline was that the P-51B/C pilots suffered from poor cockpit visibility. This problem had, to a limited extent, been solved in the field through the introduction of the Malcolm hood modification. Created by the British, the hood was a semi-bubble unit which replaced the framed canopy on early Mustangs. Rails were added on either side of the cockpit wall to allow the canopy to be slid back, but this 'field mod' was only an interim measure.

The primary reason for the lack of one-piece clear vision canopies in the early war years was that the technology required to create a large 'blown' plexiglass transparency simply did not exist. However, the incredible pressure of wartime development saw such technology and machinery quickly developed which ensured that a bubble canopy could be created that would take the pressure of high speed flight and the stress of combat. Thus, NAA engineers began sketching out a drawing of a P-51B with a bubble canopy, and the paper results produced a sleek looking aircraft with virtually unprecedented visibility.

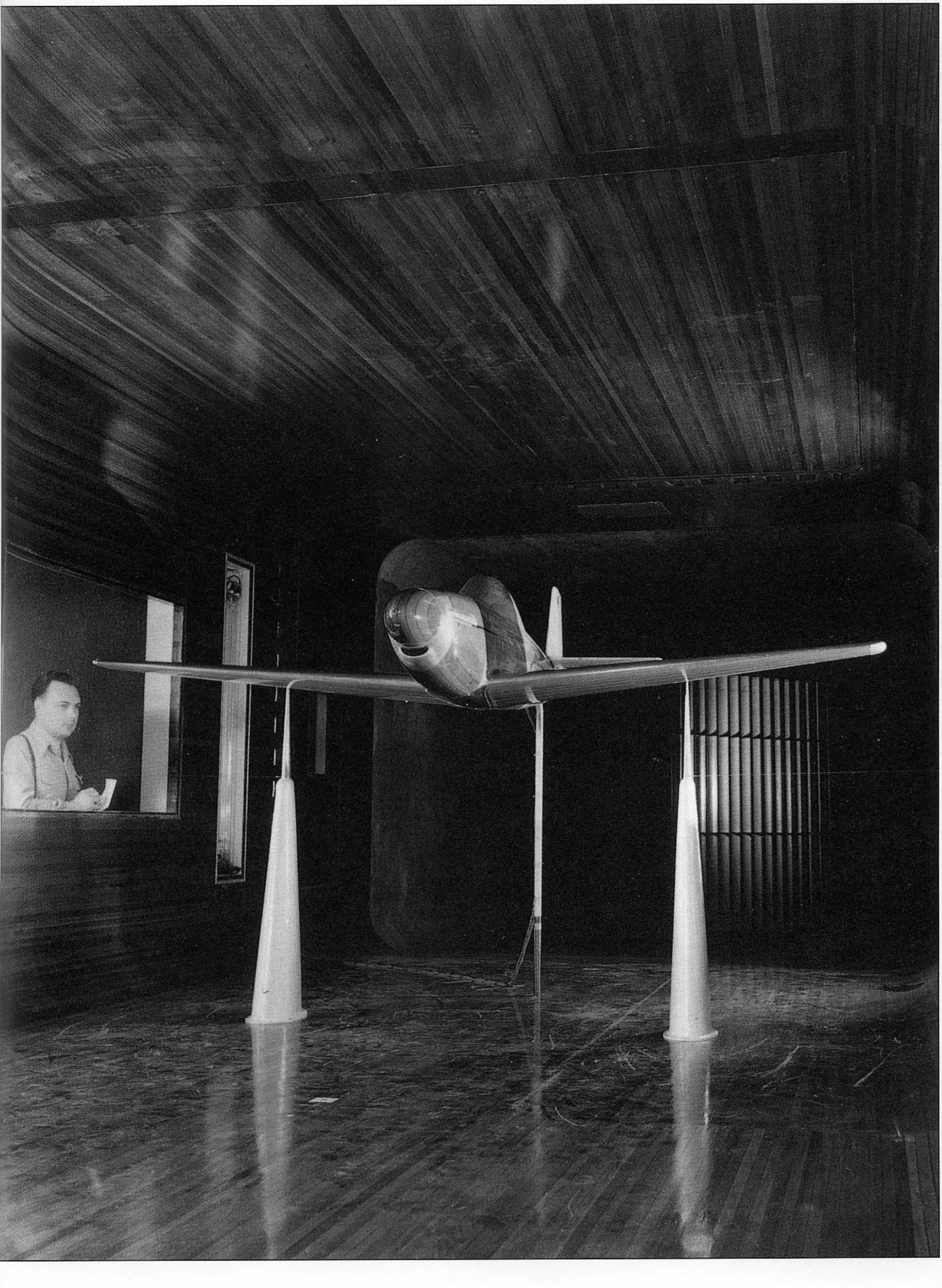
The next step was to create a beautifully crafted wind tunnel model so that the bubble canopy concept could be tested. By this time NAA had realised the importance of having their own dedicated tunnel and, accordingly, allocated a large sum of money and critical wartime materials to construct it in a fortress-like concrete building at the Inglewood plant. Prior to the advent of the NAA tunnel, the company had to depend entirely upon other local sites (especially the one at Cal Tech), which operated on a schedule giving a certain time to each manufacturer. Weeks, sometimes months, of precious time were often wasted in waiting for a chance to use these tunnels. With

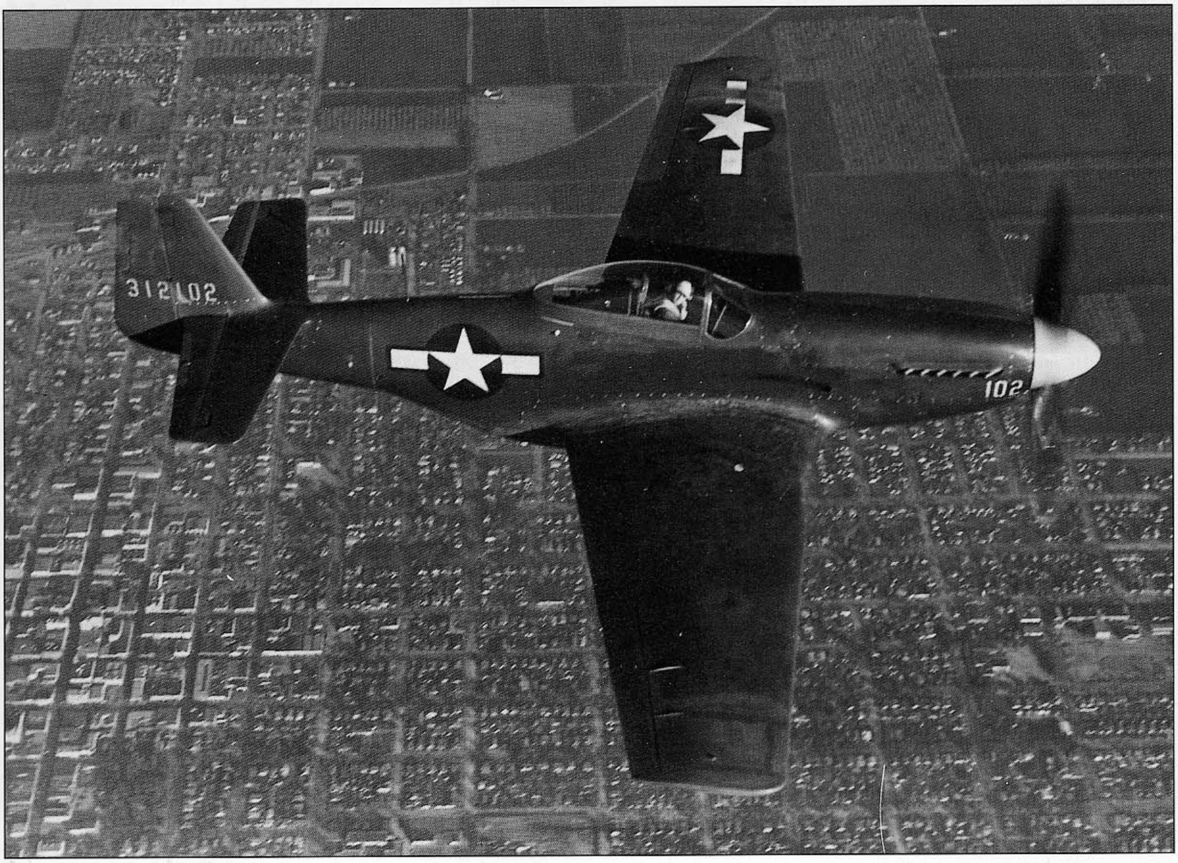


ABOVE The North American assembly hangars resound with the noise of P-51D production in full swing. This photograph shows D-models rapidly nearing completion as they head toward the exit door – the lead aircraft has had its four-blade Hamilton Standard cuffed hydromatic propeller already fitted. Note the uncompleted fuselages on the right that seem to head off into infinity. They would finally make a 180° turn and head back towards the photographer as more and more equipment was added

RIGHT Testing out the bubble canopy concept in the new North American wind tunnel. Built of mahogany and metal, and costing $20,000, the quarter-scale model was sanded down by hand and given five coats of lacquer so that it shined like a fine violin. Weighing 400 lbs, the test model was firmly anchored to its support pylons, since the tunnel could produce air speeds of up to 325 mph. When the model was set up for a test, a 3000-hp motor, driving a seven-blade 19-ft propeller at a maximum of 700 rpm, could send the air flow back over the model at high speed.

The model was adjusted for the first run at a zero angle of attack in order to initially get normal reactions, its final setting being accurate to within 1/100th of a degree. Allowing for the weight of the model, all scales were set for zero

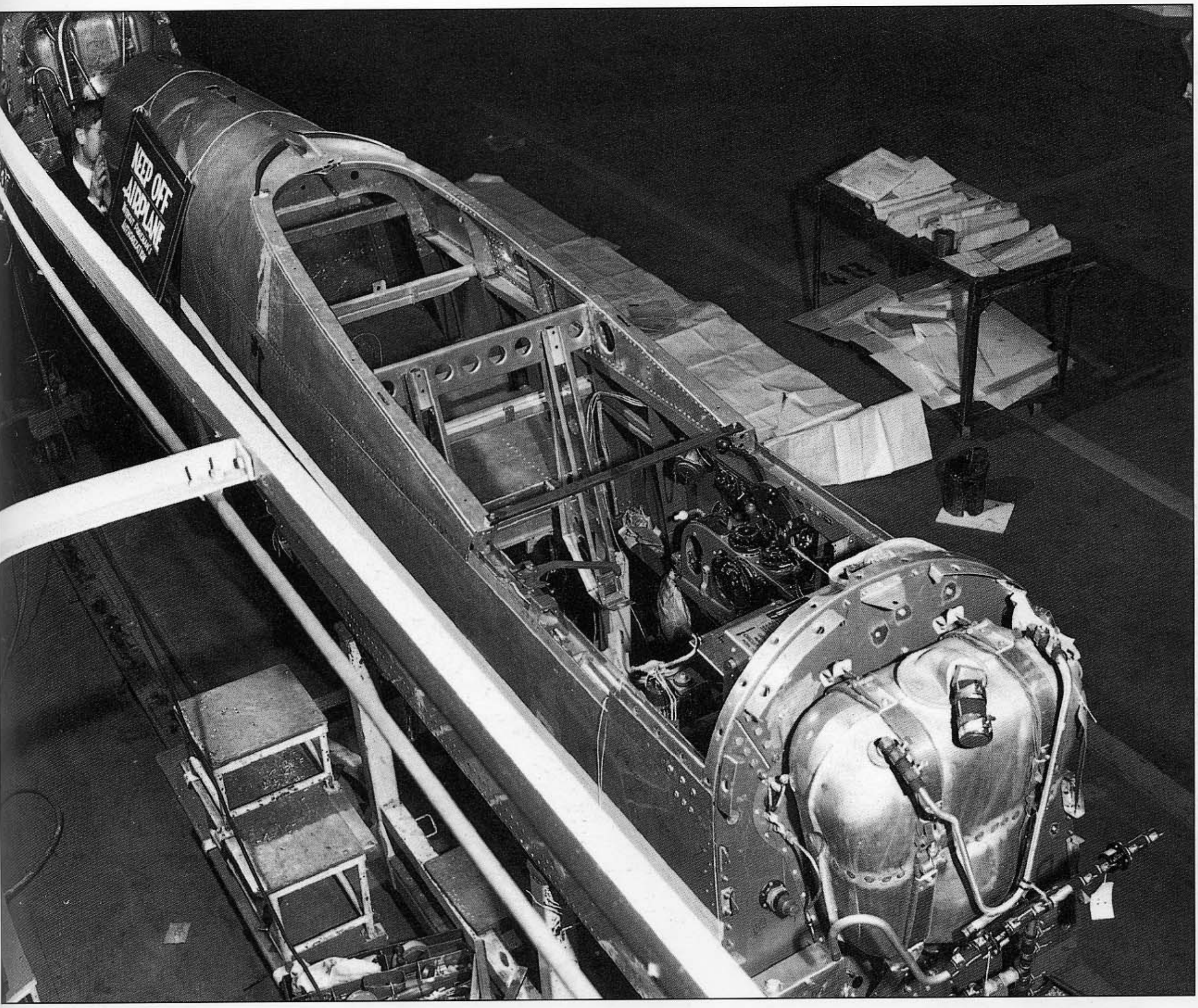


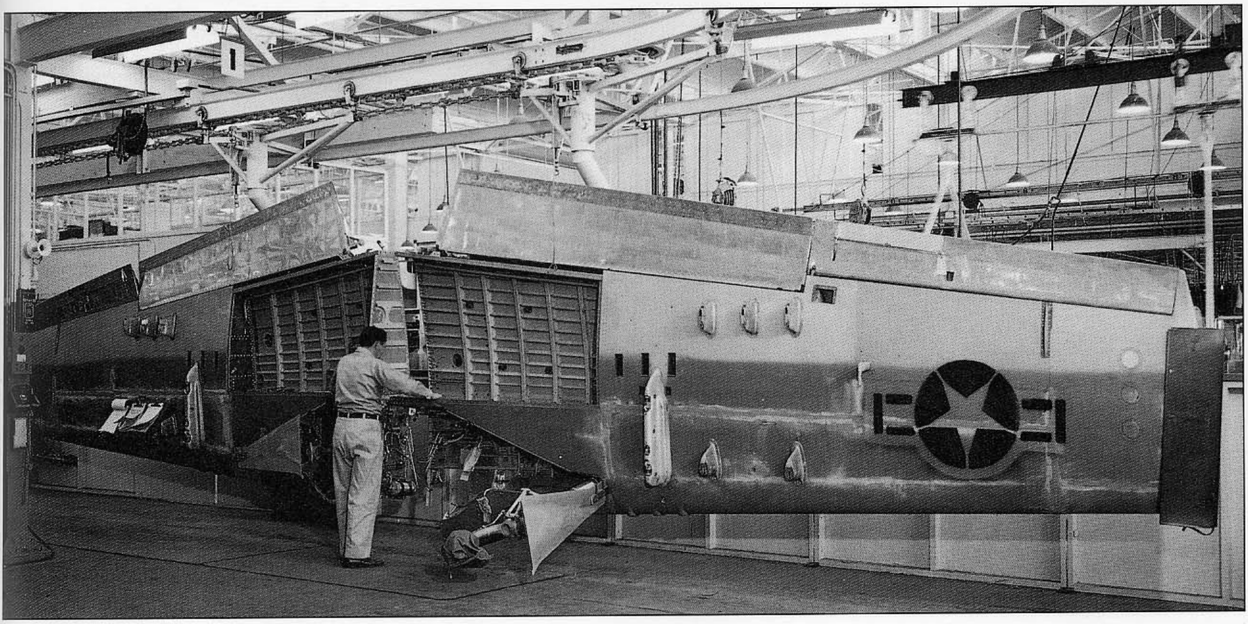


ABOVE Few of the early fighters of World War 2 had cockpits which offered good visibility due to the built up canopies (a structure that utilised numerous metal frames to hold plexiglass panels) then employed. The frames hindered vision under normal conditions, and could play havoc if the aircraft was being operated at night or in poor weather. Accordingly, on 27 February 1943 two P-51B-1-10-NA airframes were bailed back to NAA for the development of a bubble canopy which would lead to the production of a new Mustang variant – the P-51D. Bob Chilton is seen flying P-51B 43-12102 with the sleek new canopy in place. From this view, it is very evident how the visibility from the cockpit was drastically improved

OPPOSITE TOP The firewall and oil tank (note the heavy duty straps that would keep the oil tank firmly in place, even during the most severe of combat manoeuvres) are attached to the basic P-51D fuselage, to which the majority of internal fittings and controls are already in place. Four longerons and formers composed this simple, yet very rugged, structure

OPPOSITE BELOW A P-51D wing nearing completion. Note how the forward 40 per cent of the airfoil has been primered, filled and sanded. At this point, the basic landing gear structure has been installed, along with the aluminium drop tank/bomb pylons and stubs for the 5-in rockets. Also not the crude stencil application of the US national insignia. The large stress doors have not yet been put in place, waiting for the installation of the fuel tanks


KEEP OFF
AIRPLANE



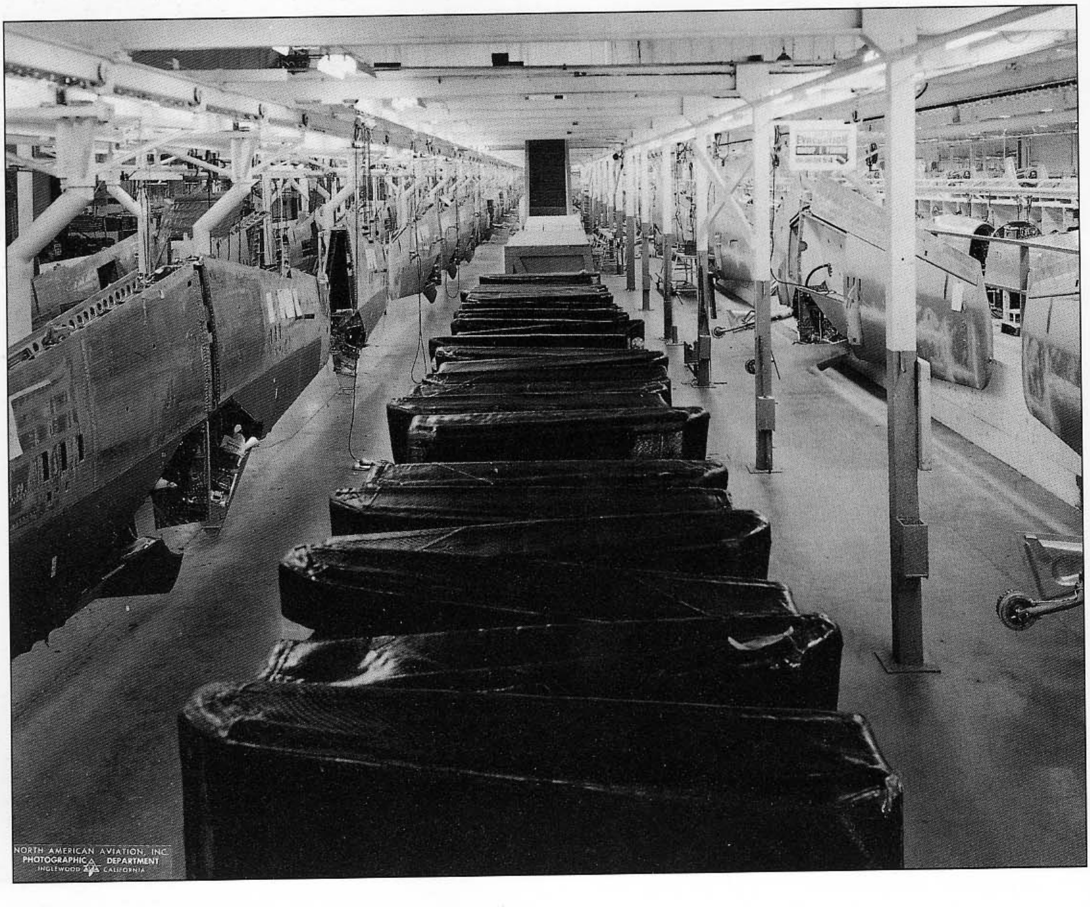
the new tunnel, NAA engineers could run tests continuously and quickly, covering a much larger field than before.

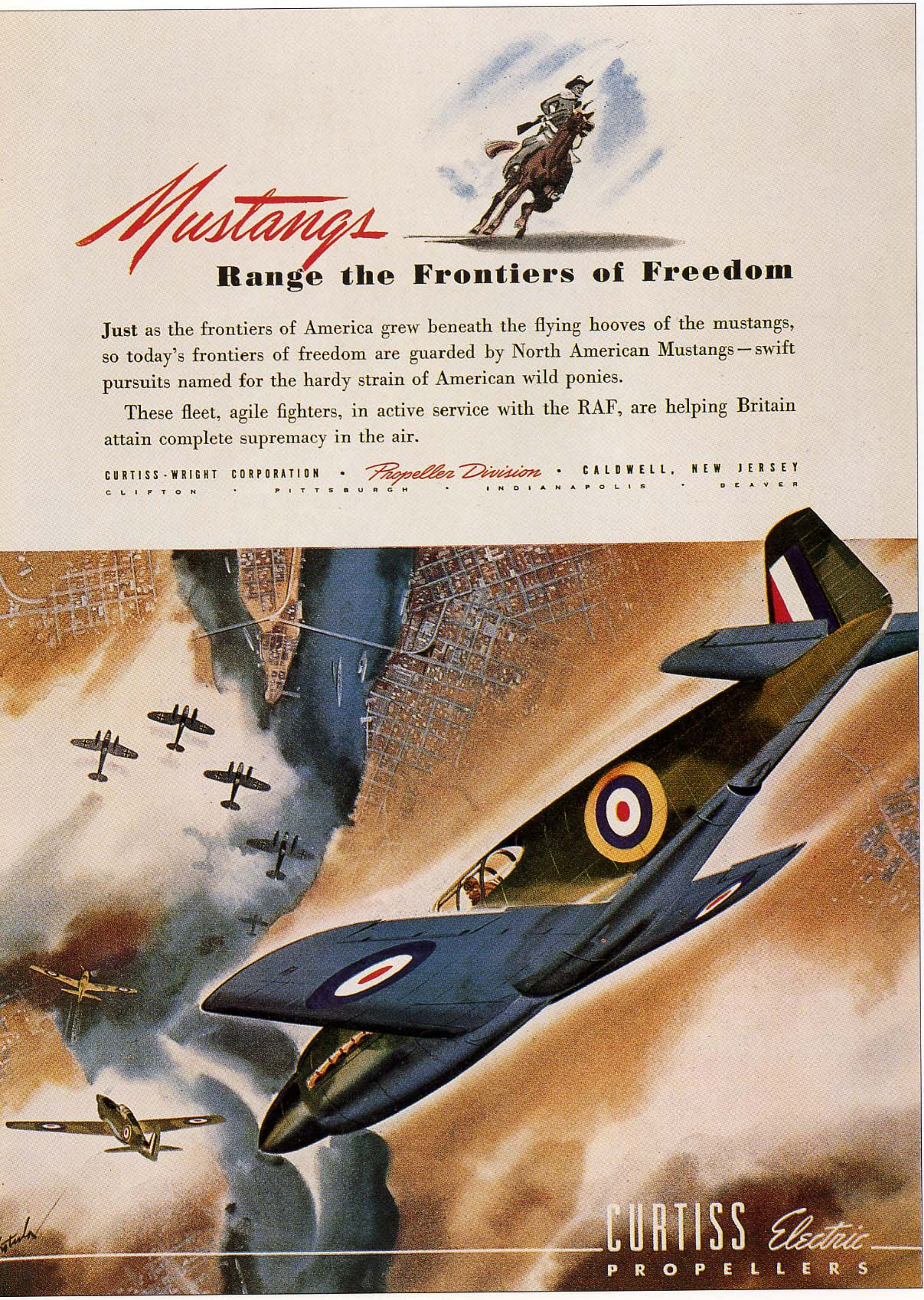
The tunnel utilised a 3000-hp powerplant which drove a seven-blade 19-ft propeller at up to 700 rpms, and this could get the air moving at speeds of up to 325 mph. A 200-hp auxiliary system supplied power for motors to run propellers in the models and for various other operations.

Scientific considerations governed all the details in the construction of the tunnel. The redwood test section was supported on steel 'I' beams, anchored at each end to the concrete portion of the tunnel. The power and propeller section was doubly strong, whilst the walls of the control and computing room were floating and heavily sound proofed. About 200 years ago, Venturi discovered that, as a passageway narrowed down, the flow of air through it gained speed – hence the Venturi effect – and the NAA tunnel was built on that principle. The air stream narrowed down nearly eight times, making high speeds possible through the test section.

The problem of making the air flow smoothly around the square angles of the tunnel was solved by curved metal vanes or plates set up at the corners. Since a temperature of 150° centigrade might develop in the air stream during continuous operation at high speeds, water-cooling of the vanes was

BELOW Bullet-proof fuel tanks await installation in the wing. Wing conveyor lines A and B were photographed on 29 July 1944





Mustangs Range the Frontiers of Freedom

Just as the frontiers of America grew beneath the flying hooves of the mustangs, so today's frontiers of freedom are guarded by North American Mustangs—swift pursuits named for the hardy strain of American wild ponies.

These fleet, agile fighters, in active service with the RAF, are helping Britain attain complete supremacy in the air.

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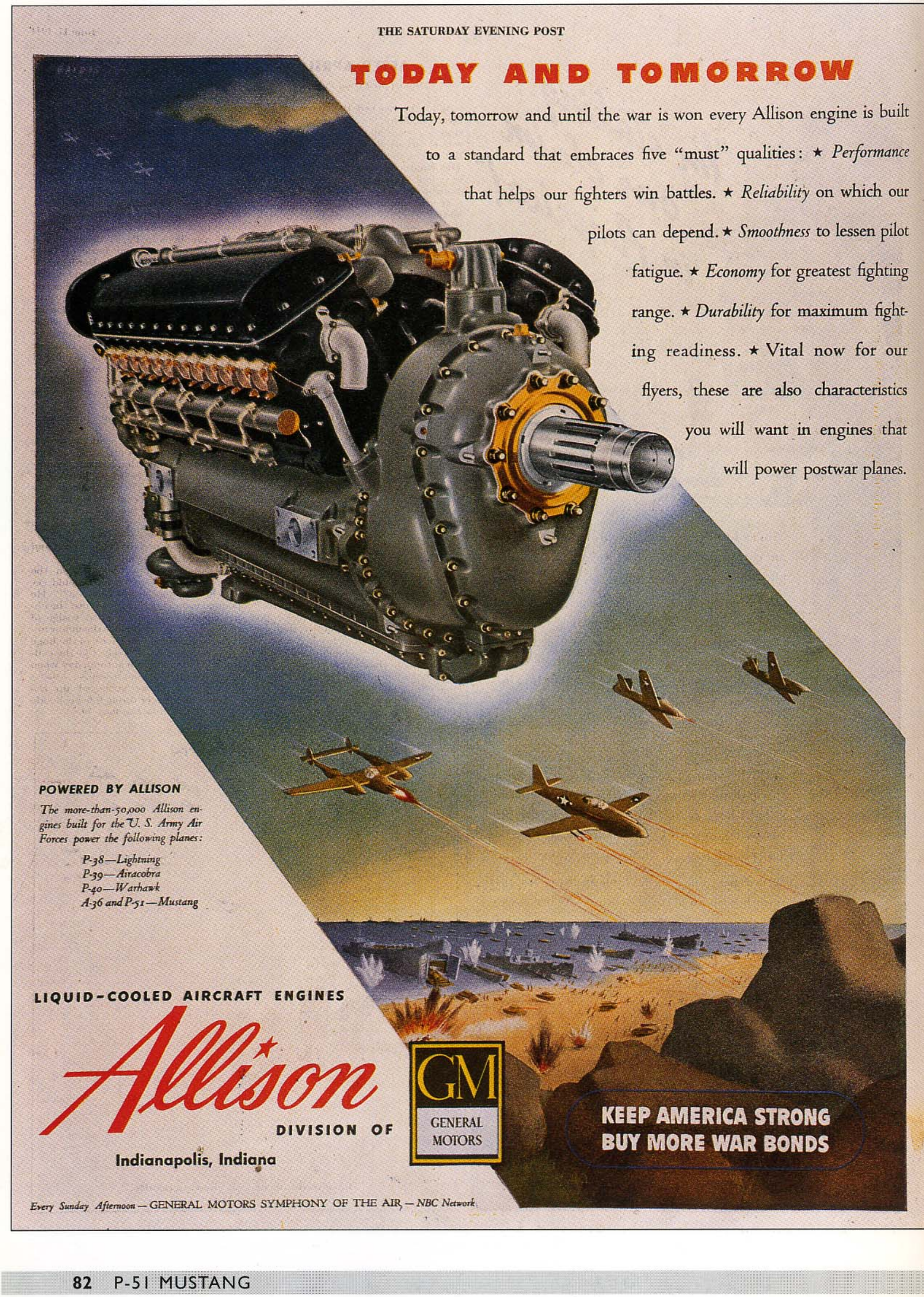


THE SATURDAY EVENING POST

TODAY AND TOMORROW

Today, tomorrow and until the war is won every Allison engine is built to a standard that embraces five "must" qualities: ★ *Performance* that helps our fighters win battles. ★ *Reliability* on which our pilots can depend. ★ *Smoothness* to lessen pilot fatigue. ★ *Economy* for greatest fighting range. ★ *Durability* for maximum fighting readiness. ★ Vital now for our flyers, these are also characteristics you will want in engines that will power postwar planes.

POWERED BY ALLISON

The more-than-50,000 Allison engines built for the U. S. Army Air Forces power the following planes:

P-38—Lightning
P-39—Airacobra
P-40—Warhawk
A-36 and P-51—Mustang

LIQUID-COOLED AIRCRAFT ENGINES

Allison

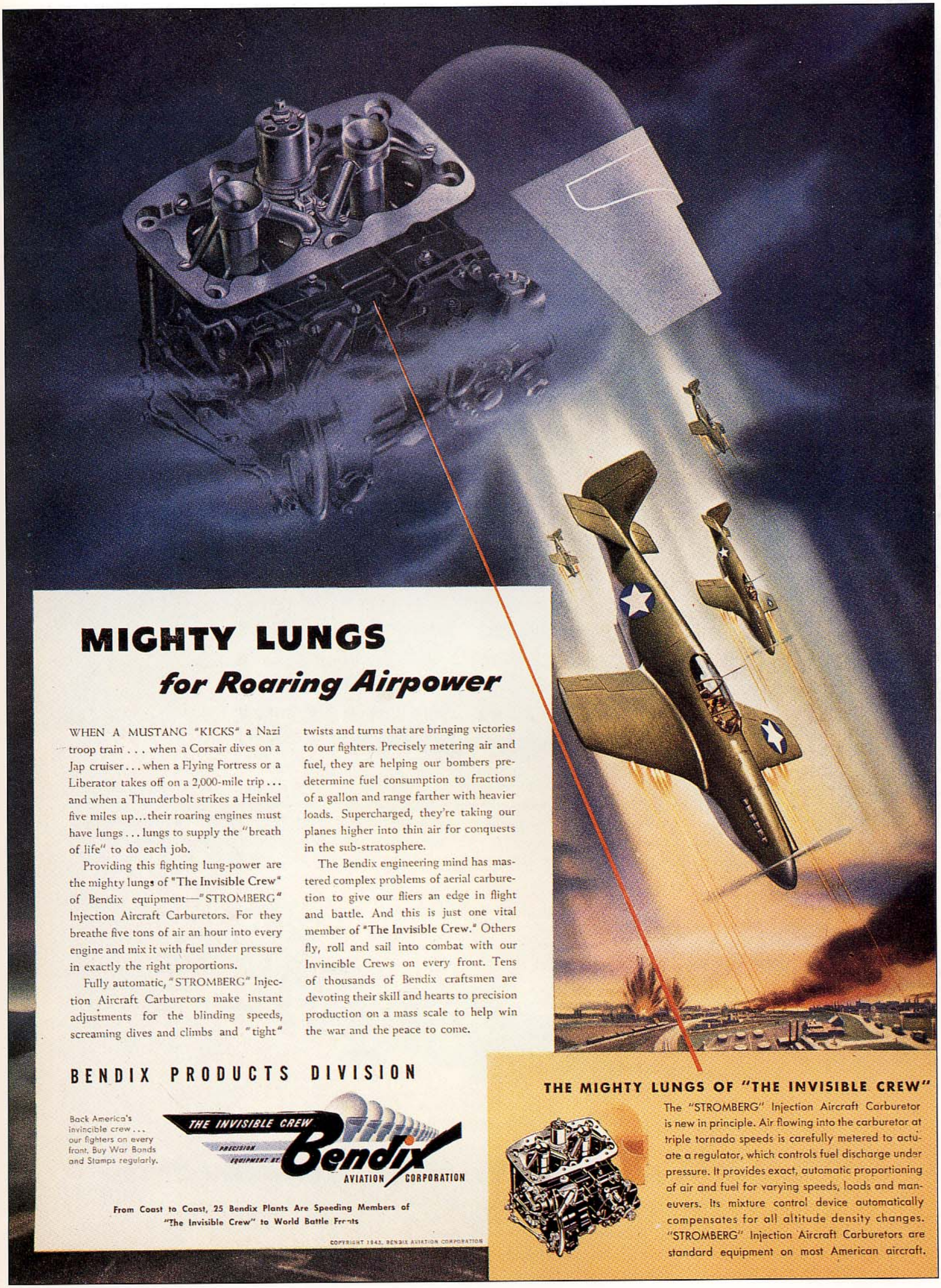
DIVISION OF

GM
GENERAL MOTORS

Indianapolis, Indiana

KEEP AMERICA STRONG
BUY MORE WAR BONDS

Every Sunday Afternoon—GENERAL MOTORS SYMPHONY OF THE AIR—*NBC Network*



MIGHTY LUNGS
for Roaring Airpower

WHEN A MUSTANG "KICKS" a Nazi troop train . . . when a Corsair dives on a Jap cruiser . . . when a Flying Fortress or a Liberator takes off on a 2,000-mile trip . . . and when a Thunderbolt strikes a Heinkel five miles up . . . their roaring engines must have lungs . . . lungs to supply the "breath of life" to do each job.

Providing this fighting lung-power are the mighty lungs of "The Invisible Crew" of Bendix equipment—"STROMBERG" Injection Aircraft Carburetors. For they breathe five tons of air an hour into every engine and mix it with fuel under pressure in exactly the right proportions.

Fully automatic, "STROMBERG" Injection Aircraft Carburetors make instant adjustments for the blinding speeds, screaming dives and climbs and "tight" twists and turns that are bringing victories to our fighters. Precisely metering air and fuel, they are helping our bombers predetermine fuel consumption to fractions of a gallon and range farther with heavier loads. Supercharged, they're taking our planes higher into thin air for conquests in the sub-stratosphere.

The Bendix engineering mind has mastered complex problems of aerial carburetion to give our fliers an edge in flight and battle. And this is just one vital member of "The Invisible Crew." Others fly, roll and sail into combat with our Invincible Crews on every front. Tens of thousands of Bendix craftsmen are devoting their skill and hearts to precision production on a mass scale to help win the war and the peace to come.

BENDIX PRODUCTS DIVISION

Back America's invincible crew . . . our fighters on every front. Buy War Bonds and Stamps regularly.

THE INVISIBLE CREW
PRECISION EQUIPMENT BY
Bendix
AVIATION CORPORATION

From Coast to Coast, 25 Bendix Plants Are Speeding Members of "The Invisible Crew" to World Battle Fronts

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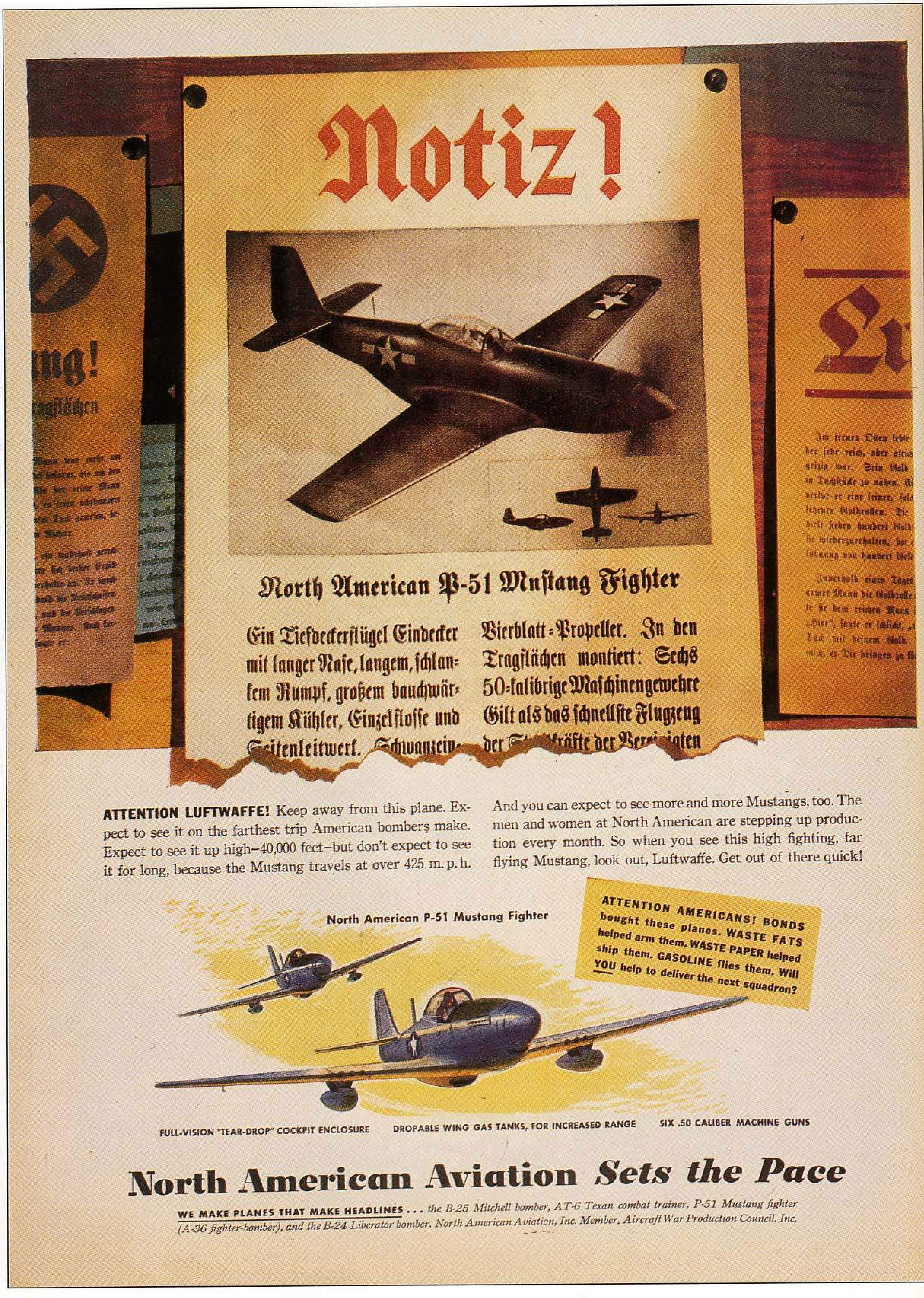
THE MIGHTY LUNGS OF "THE INVISIBLE CREW"

The "STROMBERG" Injection Aircraft Carburetor is new in principle. Air flowing into the carburetor at triple tornado speeds is carefully metered to actuate a regulator, which controls fuel discharge under pressure. It provides exact, automatic proportioning of air and fuel for varying speeds, loads and maneuvers. Its mixture control device automatically compensates for all altitude density changes. "STROMBERG" Injection Aircraft Carburetors are standard equipment on most American aircraft.



Notiz!

North American P-51 Muſtang Fighter

Ein Tiefdeckerflügel Eindecker mit langer Naſe, langem, ſchlankem Rumpf, großem bauchwärtigem Kühler, Einzelfloſſe und Seitenleitwerk. Schwanzein-

Vierblatt-Propeller. In den Tragflächen montiert: Sechs 50-kalibrige Maſchinengewehre Gilt als das ſchnellſte Flugzeug der [illegible]kräfte der Ver[illegible]igten

ATTENTION LUFTWAFFE! Keep away from this plane. Expect to see it on the farthest trip American bombers make. Expect to see it up high—40,000 feet—but don't expect to see it for long, because the Mustang travels at over 425 m. p. h. And you can expect to see more and more Mustangs, too. The men and women at North American are stepping up production every month. So when you see this high fighting, far flying Mustang, look out, Luftwaffe. Get out of there quick!

ATTENTION AMERICANS! BONDS bought these planes. WASTE FATS helped arm them. WASTE PAPER helped ship them. GASOLINE flies them. Will YOU help to deliver the next squadron?

North American P-51 Mustang Fighter

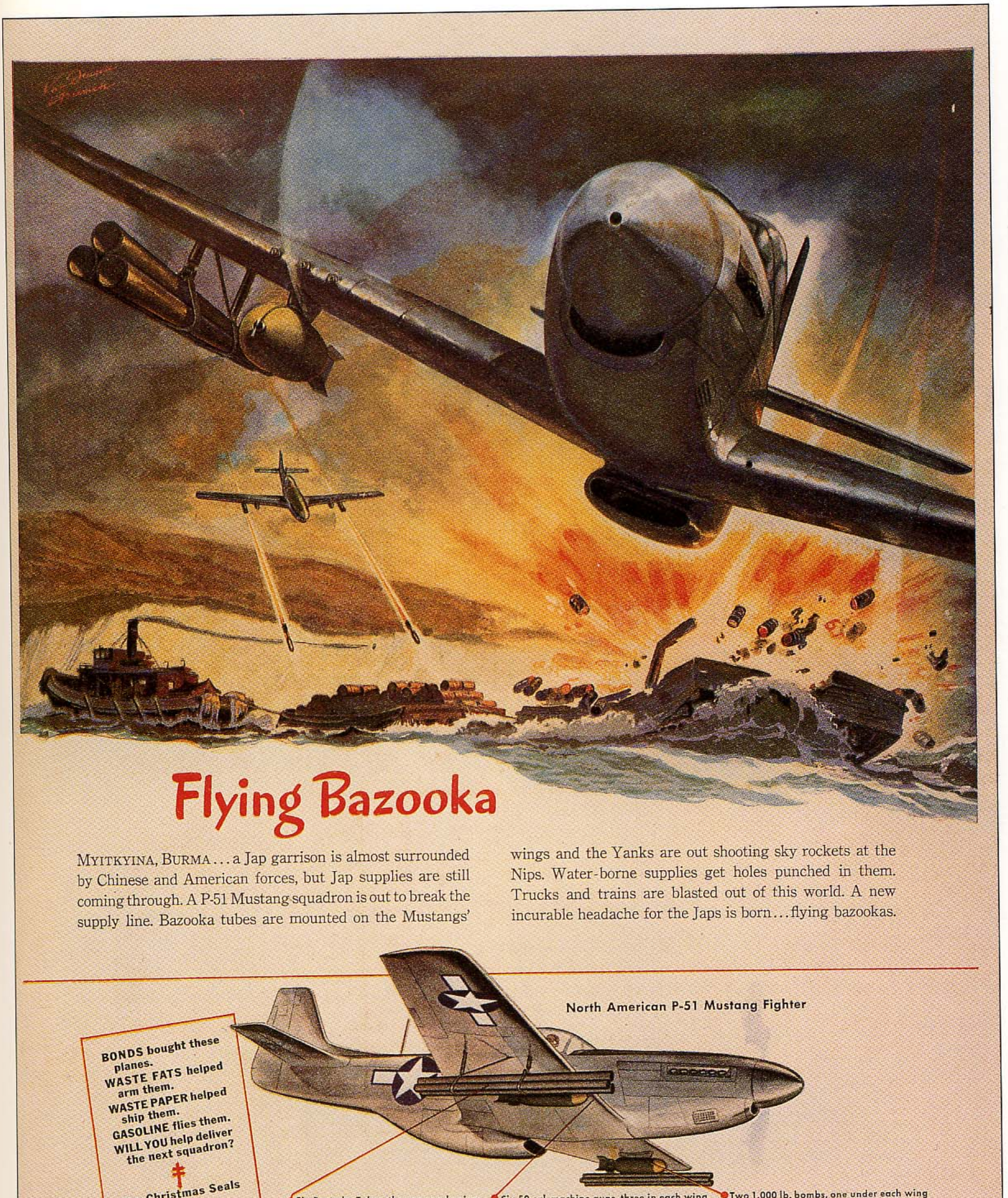
FULL-VISION "TEAR-DROP" COCKPIT ENCLOSURE

DROPABLE WING GAS TANKS, FOR INCREASED RANGE

SIX .50 CALIBER MACHINE GUNS

North American Aviation *Sets the Pace*

WE MAKE PLANES THAT MAKE HEADLINES . . . *the B-25 Mitchell bomber, AT-6 Texan combat trainer, P-51 Mustang fighter (A-36 fighter-bomber), and the B-24 Liberator bomber. North American Aviation, Inc. Member, Aircraft War Production Council, Inc.*



Flying Bazooka

MYITKYINA, BURMA . . . a Jap garrison is almost surrounded by Chinese and American forces, but Jap supplies are still coming through. A P-51 Mustang squadron is out to break the supply line. Bazooka tubes are mounted on the Mustangs' wings and the Yanks are out shooting sky rockets at the Nips. Water-borne supplies get holes punched in them. Trucks and trains are blasted out of this world. A new incurable headache for the Japs is born . . . flying bazookas.

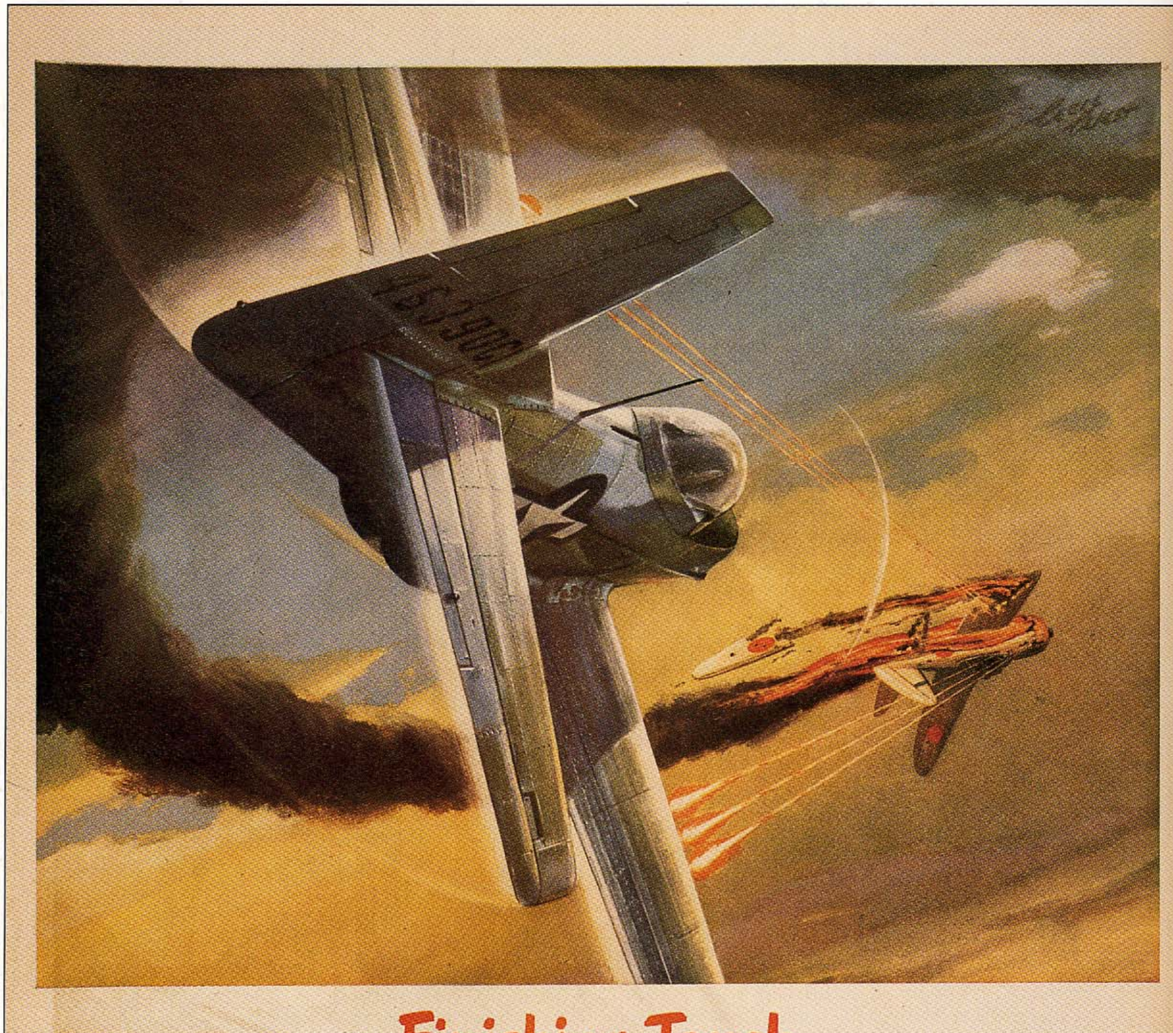
North American P-51 Mustang Fighter
Six Bazooka Tubes, three on each wing
Six 50 cal. machine guns, three in each wing
Two 1,000 lb. bombs, one under each wing

BONDS bought these planes.
WASTE FATS helped arm them.
WASTE PAPER helped ship them.
GASOLINE flies them.
WILL YOU help deliver the next squadron?
‡
Buy Christmas Seals

WORLD'S FASTEST FIGHTER PLANE . . . SPEED OVER 425 M. P. H. . . . CEILING OVER 40,000 FEET

North American Aviation *Sets the Pace*

PLANES THAT MAKE HEADLINES . . . *the P-51 Mustang fighter (A-36 fighter-bomber), B-25 and PBJ Mitchell bomber, the AT-6 and SNJ Texan combat trainer. North American Aviation, Inc. Member, Aircraft War Production Council, Inc.*



Finishing Touch

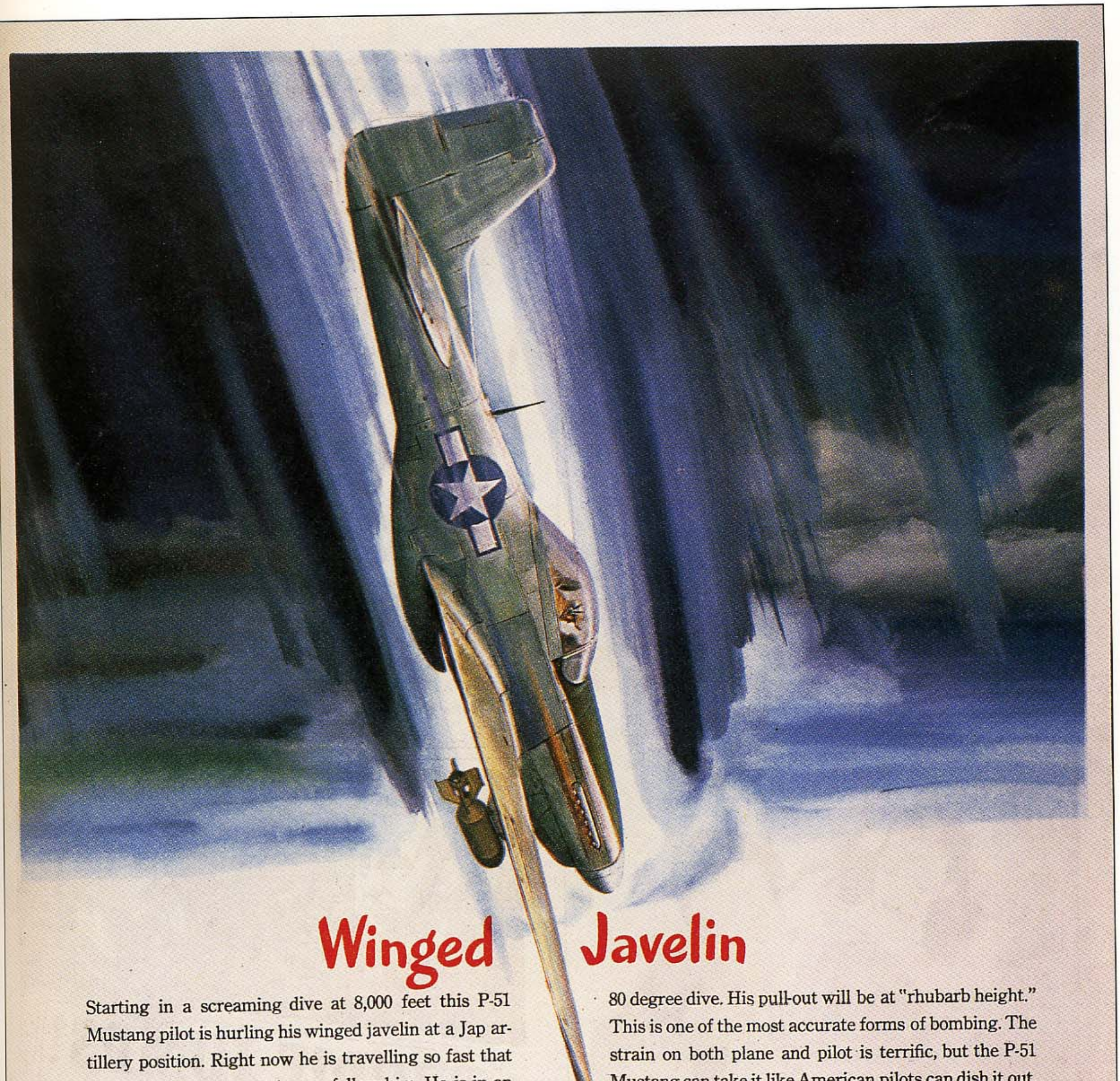
An American Mustang pilot has latched himself onto the tail of a new Nip Navy plane—the Tojo. The frantic Jap has pulled every trick in the book. Finally, in desperation he racks his Tojo into a back-breaking 180 degree vertical turn. The Mustang pilot refusing to give up his advantage, follows. Halfway around the Mustang has out-turned the Tojo. At the three-quarter mark the Jap has turned into the gun sights of the Mustang. The American pilot applies the "finishing touch."

BONDS bought these planes ★ WASTE FATS helped arm them ★ WASTE PAPER helped ship them ★ GASOLINE flies them ★ WILL YOU help deliver the next squadron?

"Hurricane Hall," famed wind tunnel at North American Aviation where engineers create man-made hurricanes to develop and test the stability and flight characteristics of the P-51 Mustang.

North American Aviation *Sets the Pace*

PLANES THAT MAKE HEADLINES... *the P-51 Mustang fighter (A-36 fighter-bomber), B-25 and PBJ Mitchell bomber, the AT-6 and SNJ Texan combat trainer. North American Aviation, Inc. Member, Aircraft War Production Council, Inc.*



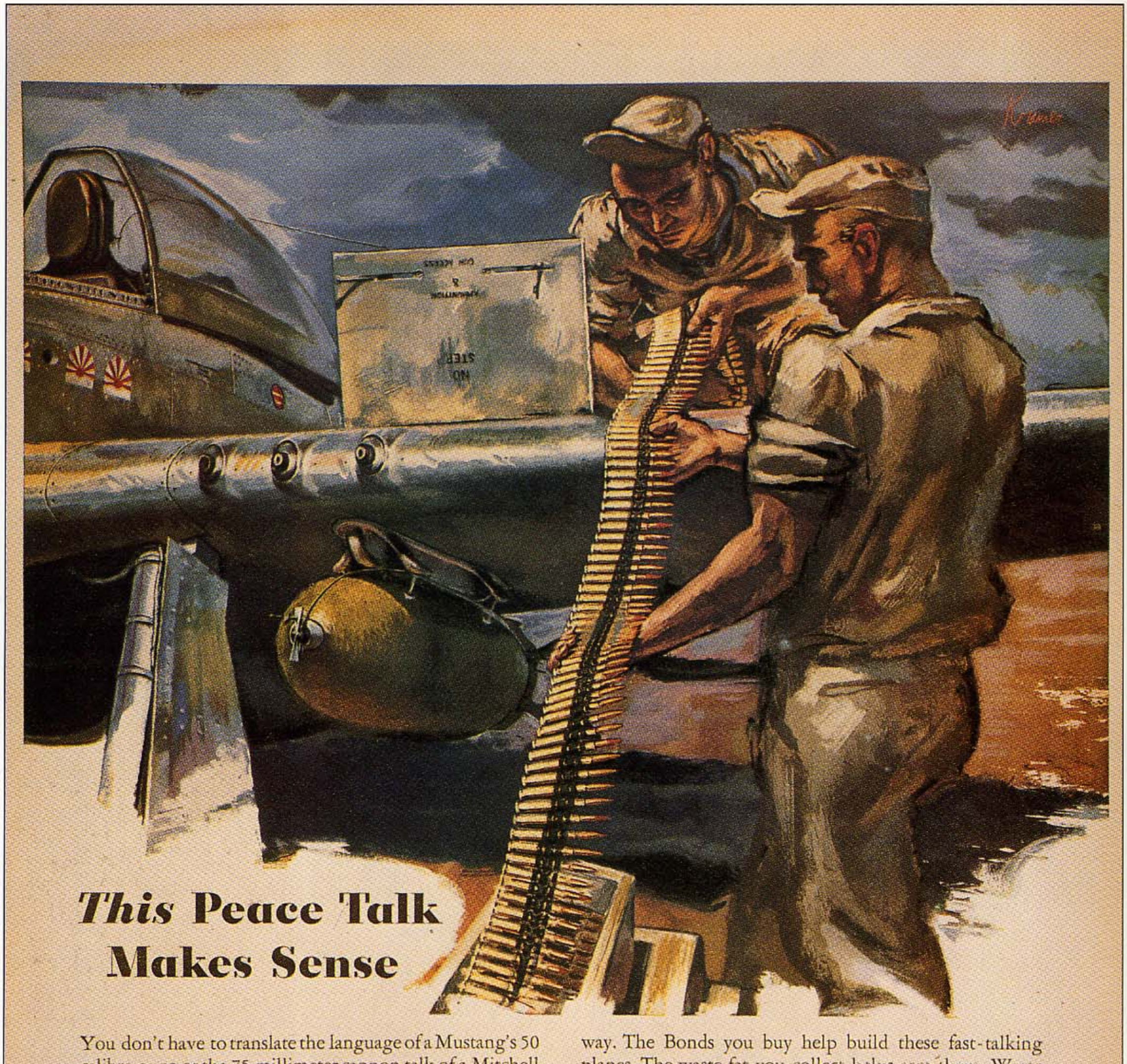
Winged Javelin

Starting in a screaming dive at 8,000 feet this P-51 Mustang pilot is hurling his winged javelin at a Jap artillery position. Right now he is travelling so fast that anti-aircraft guns cannot even follow him. He is in an 80 degree dive. His pull-out will be at "rhubarb height." This is one of the most accurate forms of bombing. The strain on both plane and pilot is terrific, but the P-51 Mustang can take it like American pilots can dish it out.

BONDS bought these planes.
WASTE FATS helped arm them.
WASTE PAPER helped ship them.
GASOLINE flies them.
WILL YOU help deliver the next squadron?

North American Aviation *Sets the Pace*

PLANES THAT MAKE HEADLINES... *the P-51 Mustang fighter (A-36 fighter-bomber), B-25 and PBJ Mitchell bomber, the AT-6 and SNJ Texan combat trainer. North American Aviation, Inc. Member, Aircraft War Production Council, Inc.*



This Peace Talk Makes Sense

You don't have to translate the language of a Mustang's 50 calibre guns or the 75 millimeter cannon talk of a Mitchell bomber. The Japs already understand. So do the Nazis. So let's keep talking, You bet you can help! Think of it this way. The Bonds you buy help build these fast-talking planes. The waste fat you collect helps arm them. Waste paper helps ship them, and gasoline flies them. Wouldn't you like to say a few words of this kind of "peace talk," too?

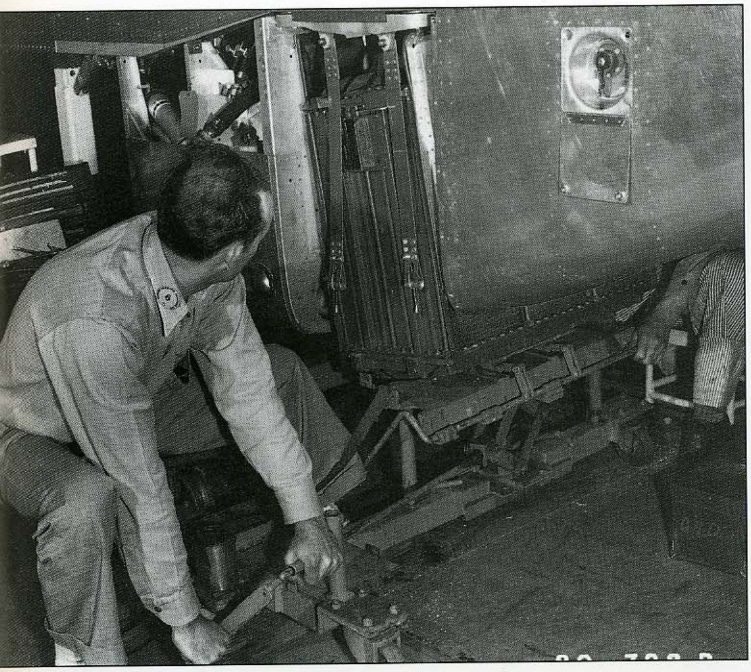
North American P-51 Mustang Fighter

BULLET-PROOF ARMOR
FULL-VISION COCKPIT ENCLOSURE
1520 H. P. SUPERCHARGED ENGINE
REVOLUTIONARY SUPER-SPEED WING
SELF-SEALING GAS TANKS
SIX 50-CAL. MACHINE GUNS, THREE IN EACH WING
1000 LB. BOMB UNDER EACH WING

THE MUSTANG IS A FIGHTER FROM THE GROUND UP! Speed: over 425 m.p.h. Ceiling: 40,000 feet Range: 2000 miles

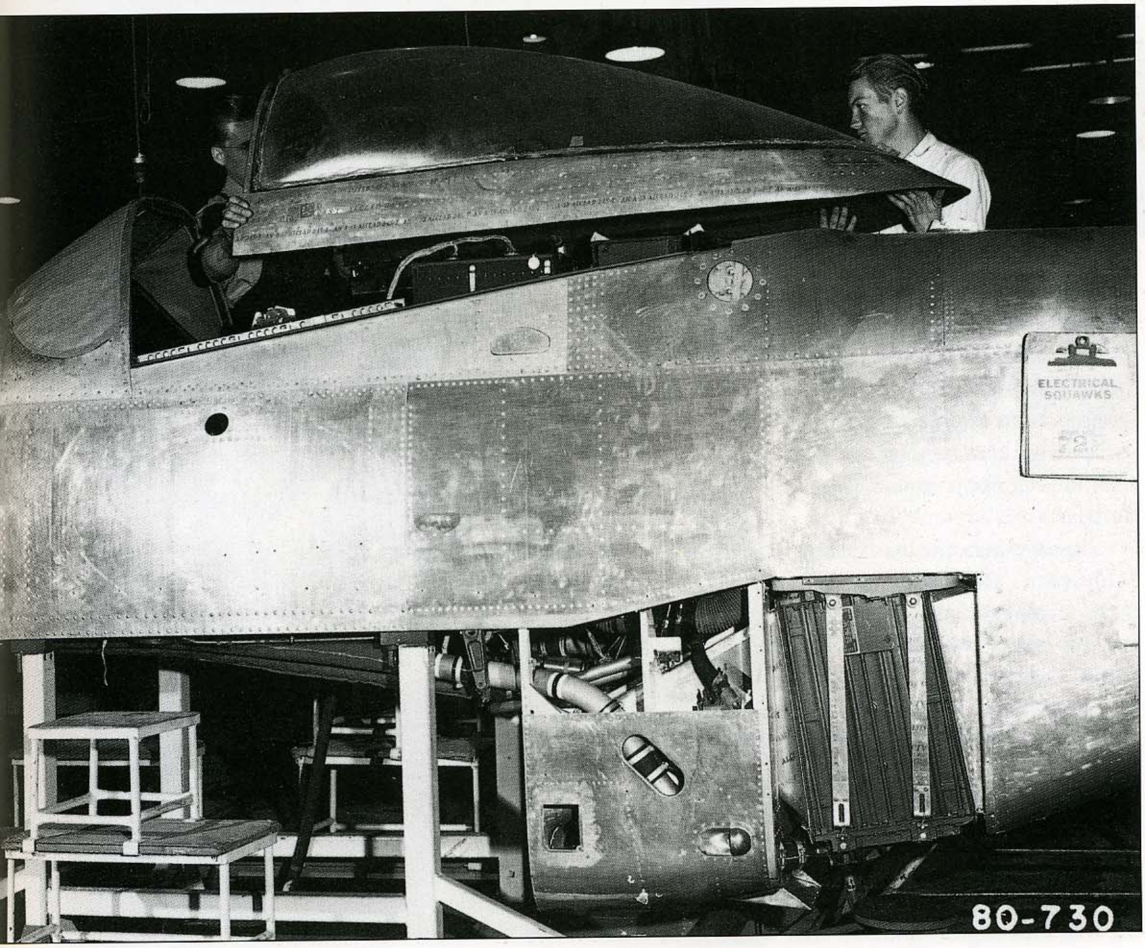
North American Aviation *Sets the Pace*

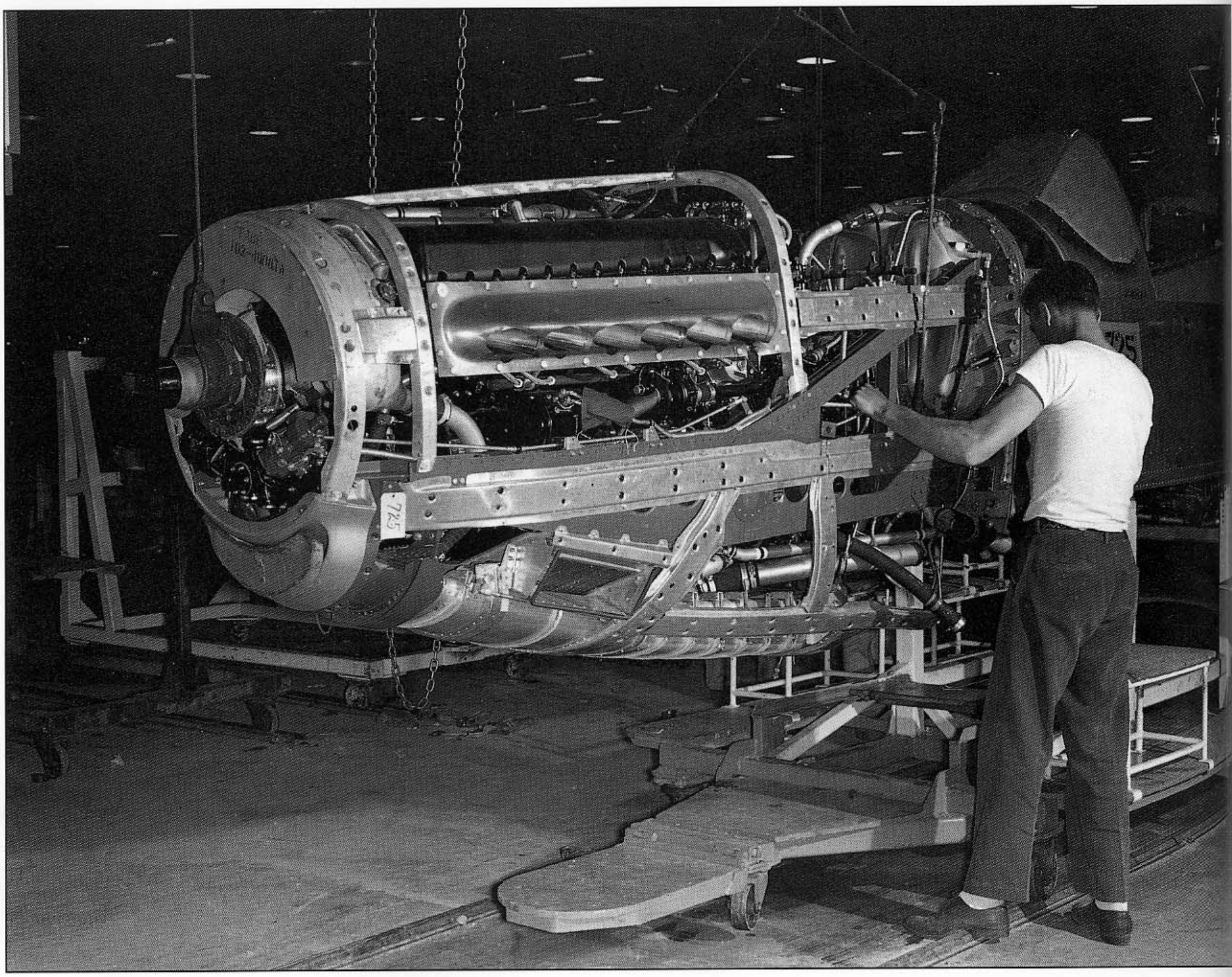
PLANES THAT MAKE HEADLINES . . . *the B-25 Mitchell bomber, AT-6 Texan combat trainer, P-51 Mustang fighter (A-36 fighter-bomber), and the B-24 Liberator bomber. North American Aviation, Inc. Member, Aircraft War Production Council, Inc.*



LEFT Boosting the Harrison radiator into position in a P-51D fuselage. Note the strong straps that would firmly hold the heavy radiator in position. The radiator had 2.7 square feet of frontal area and contained a separate section for supercharger cooling, while the oil cooler was fixed forward of the coolant radiator in its own channelled scoop with shutter

BELOW With the radiator in place and attached (this view also shows all the cooling plumbing required for the P-51D), workers prepare to fit the bubble canopy, which is still coated with protective film. Note the clip board outlining electrical 'squawks' on the side of the fuselage





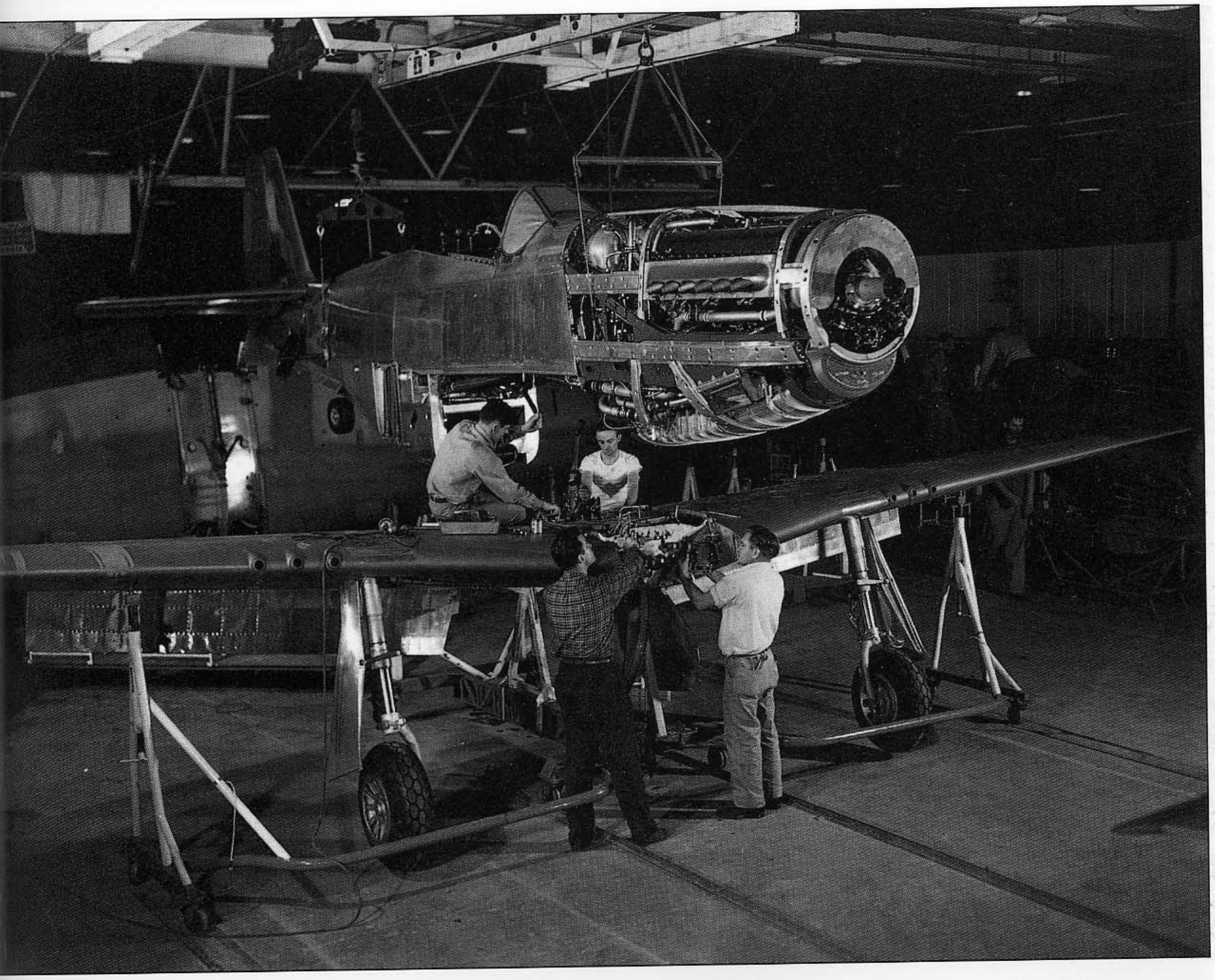
ABOVE Mating a V-1650-7 to the firewall. Finished as a complete unit, the entire engine installation was a masterpiece of simplicity, and an engine change could be done in the field in well under 24 hours

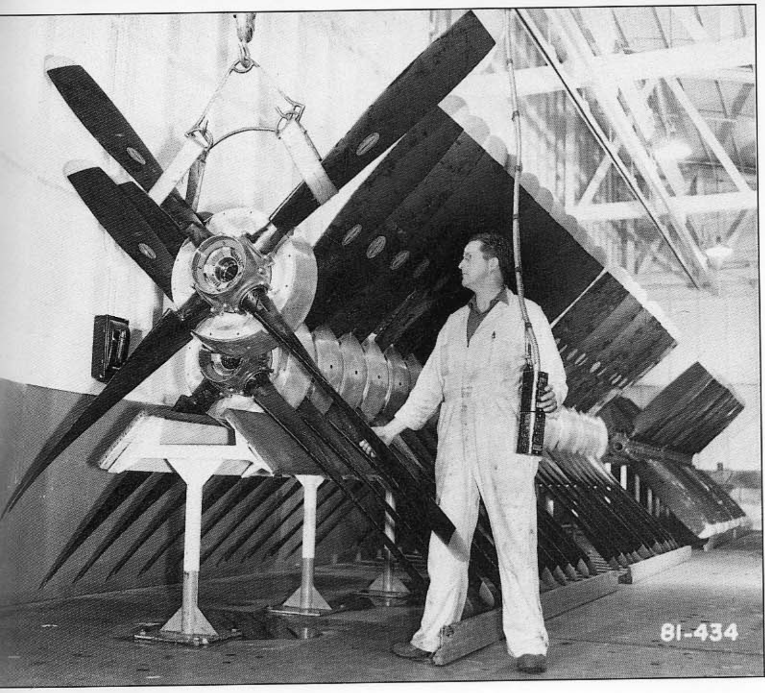
OPPOSITE TOP Moment of truth. Raised on hoists, a P-51D fuselage is prepared for mating to the wing. Rather amazingly, the structure was attached to the wing at only four points

provided. The building consisted of a basement, main floor, mezzanine and top floor. The weighing system was in the basement, whilst the main floor housed the test section, control room, hallways on each side of the test section, the thermodynamics room and accessories room. On the mezzanine were the computing and furnace rooms. At the top was the laboratory and model shop, consisting of wood working and machine shops.

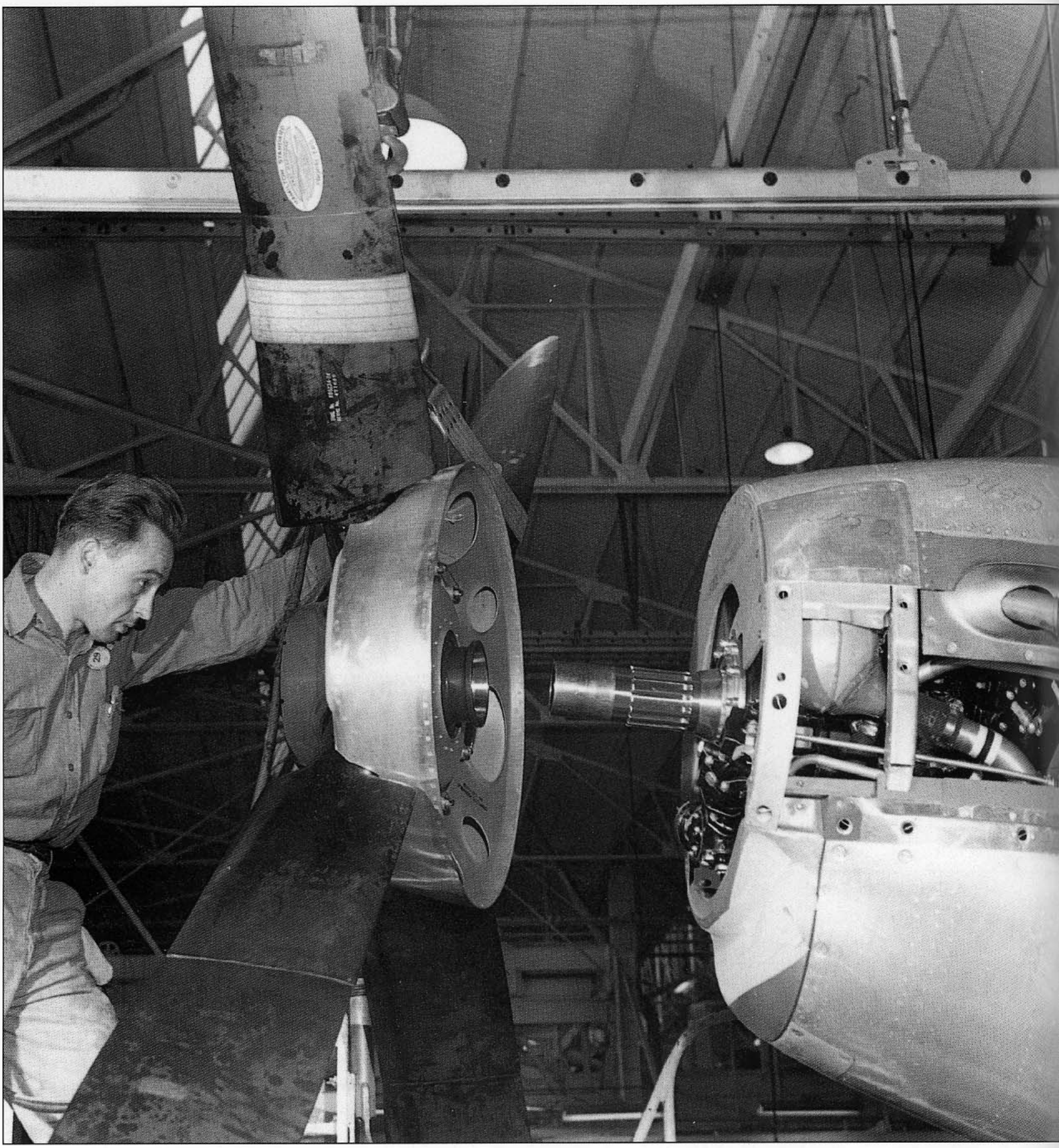
In operation, the tunnel was quite a complex piece of equipment. Once the model was in place, engineers would make a final run-through to ensure everything was functioning for the test. Powerful mercury vapour lamps were turned on while indicators were checked to make sure all doors were securely locked. If a door somehow opened during a test, the powerplant would automatically shut down. The floors had been vacuum cleaned since dust had to be removed from the atmosphere, and very little air was taken in from the outside in order to keep the test section as clean as possible.

Once the test started, the clutch was set for low speed and the power was turned on. As the speed increased, there was a rising roar and slight vibration that would fill the building as engi-





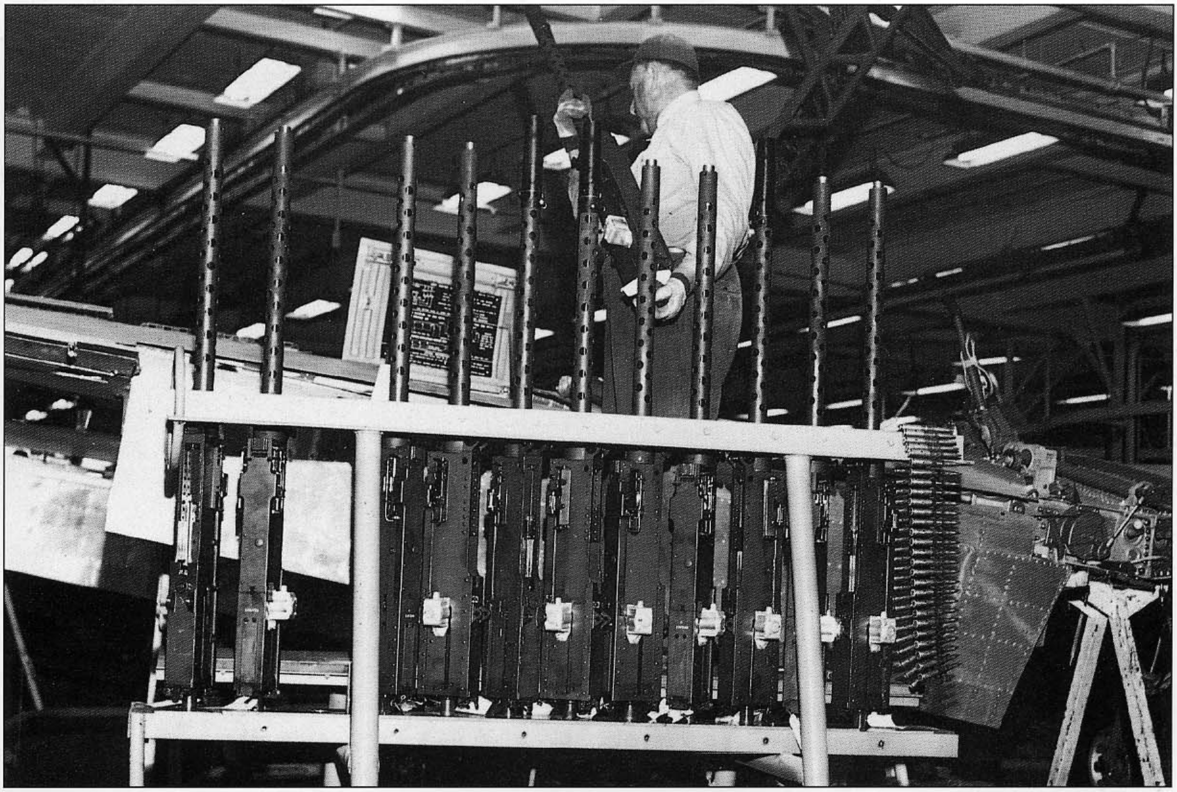
LEFT Already fitted with their back plates, Hamilton Standard propellers are guided one by one to the final assembly line. As with virtually every other major Mustang component, the propellers were moved via overhead lifts. Note the extremely stout metal and canvas strap for lifting the heavy unit

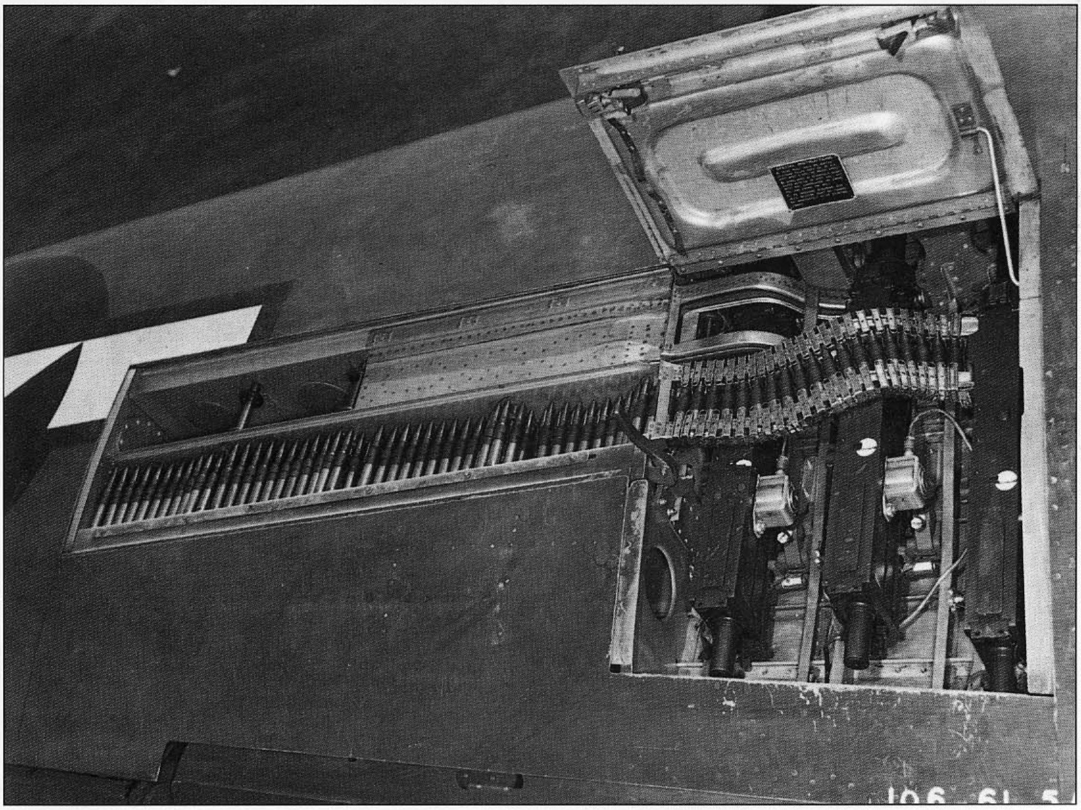


ABOVE A worker carefully guides the Hamilton Standard propeller onto the Merlin's drive shaft. Note the lightening holes that have been drilled into the spinner's back plate

OPPOSITE TOP Carried on a rolling rack, Browning .50 cal machine guns are wheeled into place for installation in a D-model's wing. In moving from the P-51B/C to the P-51D, an extra two guns were needed to fully outfit the fighter. The basic .50 cal weapon weighed 69 lbs

RIGHT Brownings in place, with ammunition access panels removed to reveal the neatness of the installation. The P-51D/K could carry no less than 1880 .50 cal rounds, with the inboard weapons having 400 rounds and the centre and outboard guns 270 rounds apiece

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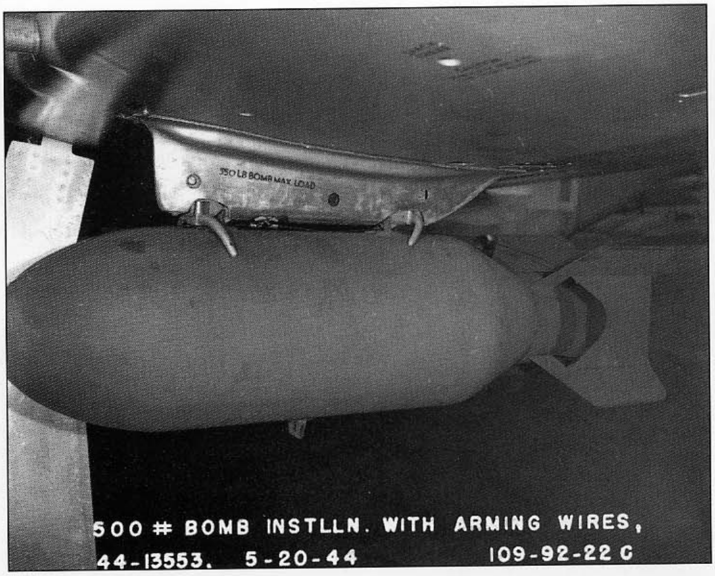
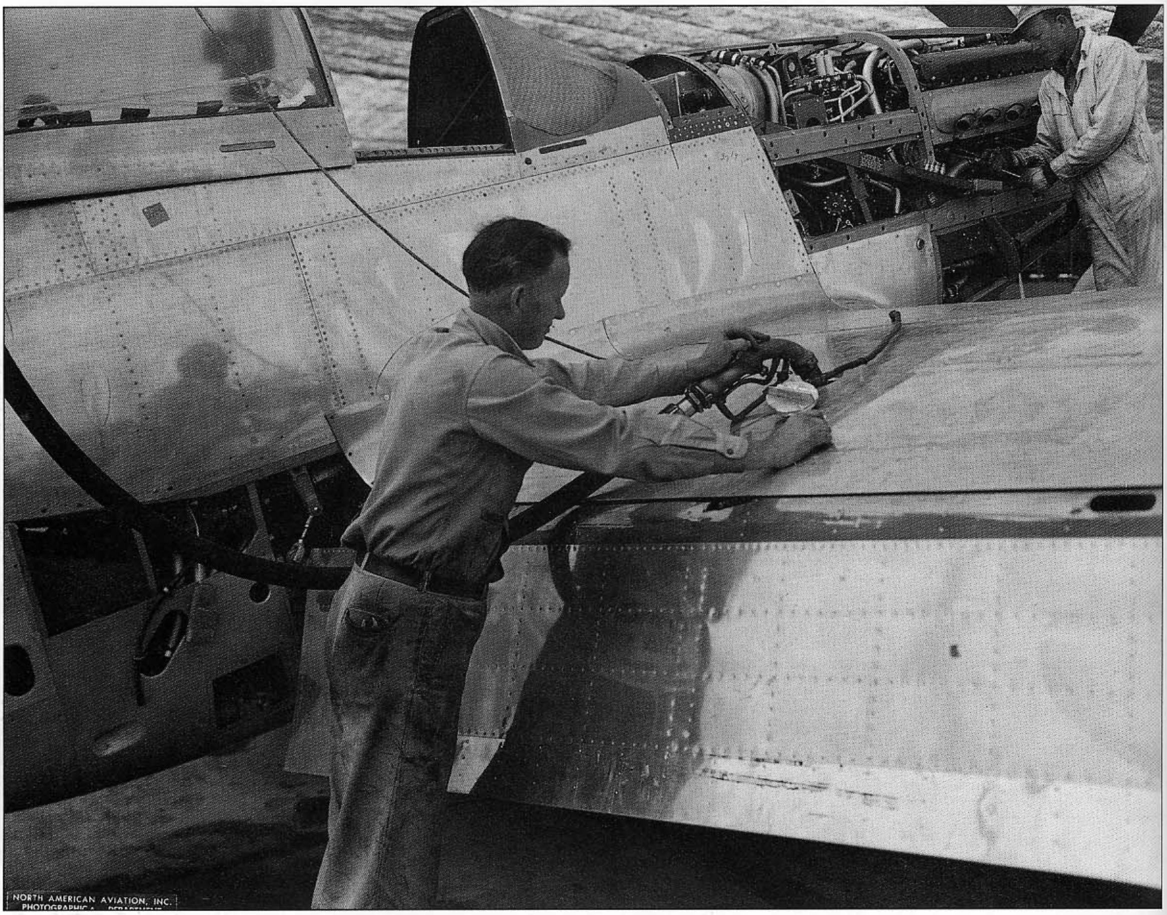
WABASH


550 LB BOMB MAX LOAD
500 # BOMB INSTLLN. WITH ARMING WIRES,
44-13553. 5-20-44 109-92-22 C

LEFT Metal underwing pylons eventually replaced earlier Phenolic resin units. Fitted with a 500-lb bomb on P-51D-5-NA 44-13553, this pylon had been stencilled for a maximum 550-lb bomb load when photographed on 20 May 1944. The load limit was later raised to 1000 lbs

LEFT At the Weber Showcase and Fixture factory in Los Angeles, hundreds of Mustang drop tanks pass through an infra-red drying system while a female worker keeps an eye on production in this 5 August 1944 photograph

RIGHT With a minimum of celebration, a worker applies a rather crude number 10,000 to identify the 10,000th Mustang as it rolls off the production line


NORTH AMERICAN AVIATION, INC.

neers carefully monitored the models, graphs and instruments to make sure that the recording graph paper was smoothly moving through the automatic recorders. When the readings for a particular setting had been obtained, the power was shut off and the engineers began rigging the model for its next test. With the second run, the graph would record the effect of the air stream on the model under new conditions.

The test section where the model was placed was a narrow tunnel throat open at both ends, its wooden walls being made of highly polished redwood and pierced by observation windows on both sides. Through the windows, NAA engineers could watch the model being tested.

Special cast steel struts supported the model on a centreline and the struts ran down through the floor, without touching it, and were anchored to a structural steel 'I' beam. This, in turn, was supported indirectly by the weighing scales through a series of rods and levers.

There were six scales to measure the lift, drag, side force, pitching, rolling and yawing movement (twisting force) on the model. An automatic recording system gave a complete graph of forces acting on the model. The scales measured the forces exerted against the model and transmitted the data electrically to the control room.

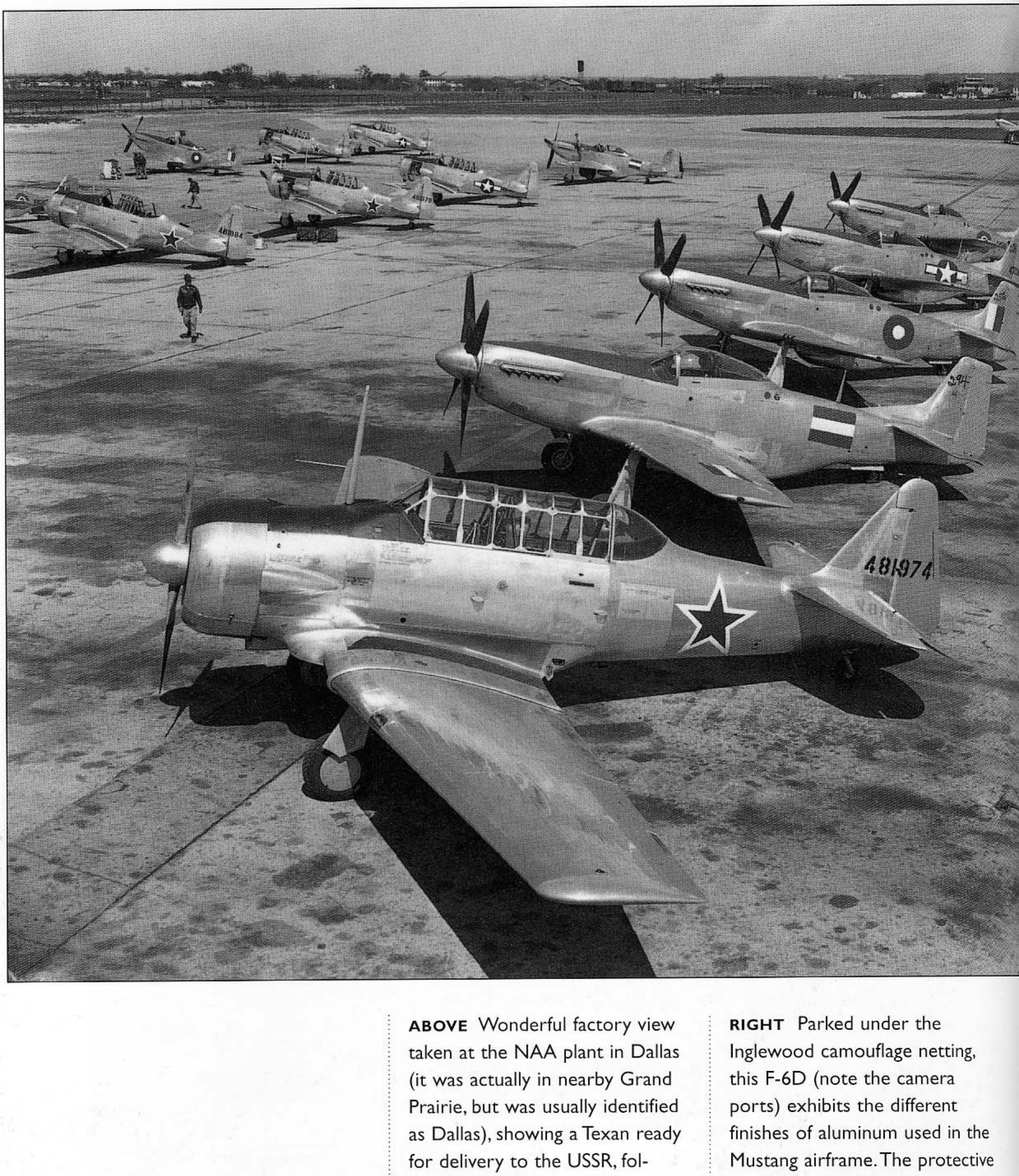
ABOVE A nearly completed Mustang just out of the assembly hall is fuelled and serviced under the camouflage netting prior to its initial engine run and systems check

OPPOSITE TOP Devoid of markings except for factory serials, Mustangs are readied for engine runs at Inglewood

RIGHT P-51D 44-72810 test fires its six Brownings into a specially designed stand that could be rolled directly to the aircraft, which remained in its parked attitude rather than groundcrews having to go to the extra work of placing the tail in an in-flight position

036
969

72810
40



ABOVE Wonderful factory view taken at the NAA plant in Dallas (it was actually in nearby Grand Prairie, but was usually identified as Dallas), showing a Texan ready for delivery to the USSR, followed by a Mustang for The Nether-lands, one for the Royal Australian Air Force, a USAAF example and, finally, a Mustang Mk IV destined for the RAF

RIGHT Parked under the Inglewood camouflage netting, this F-6D (note the camera ports) exhibits the different finishes of aluminum used in the Mustang airframe. The protective film for the bubble canopy is still in place. The weight of an F-6D Mustang increased by approximately 100 lbs due to the installation of the two cameras and associated fittings and controls. The aircraft retained its full fighter armament, however

Using lift and drag data, engineers could take the results of wind tunnel tests and determine closely what a completed aircraft could do. Without the tunnel, if it had been necessary to change an actual aircraft and fly it to correct each fault or error, the expense and time would have been prohibitive during wartime. The tunnel was a shortcut.

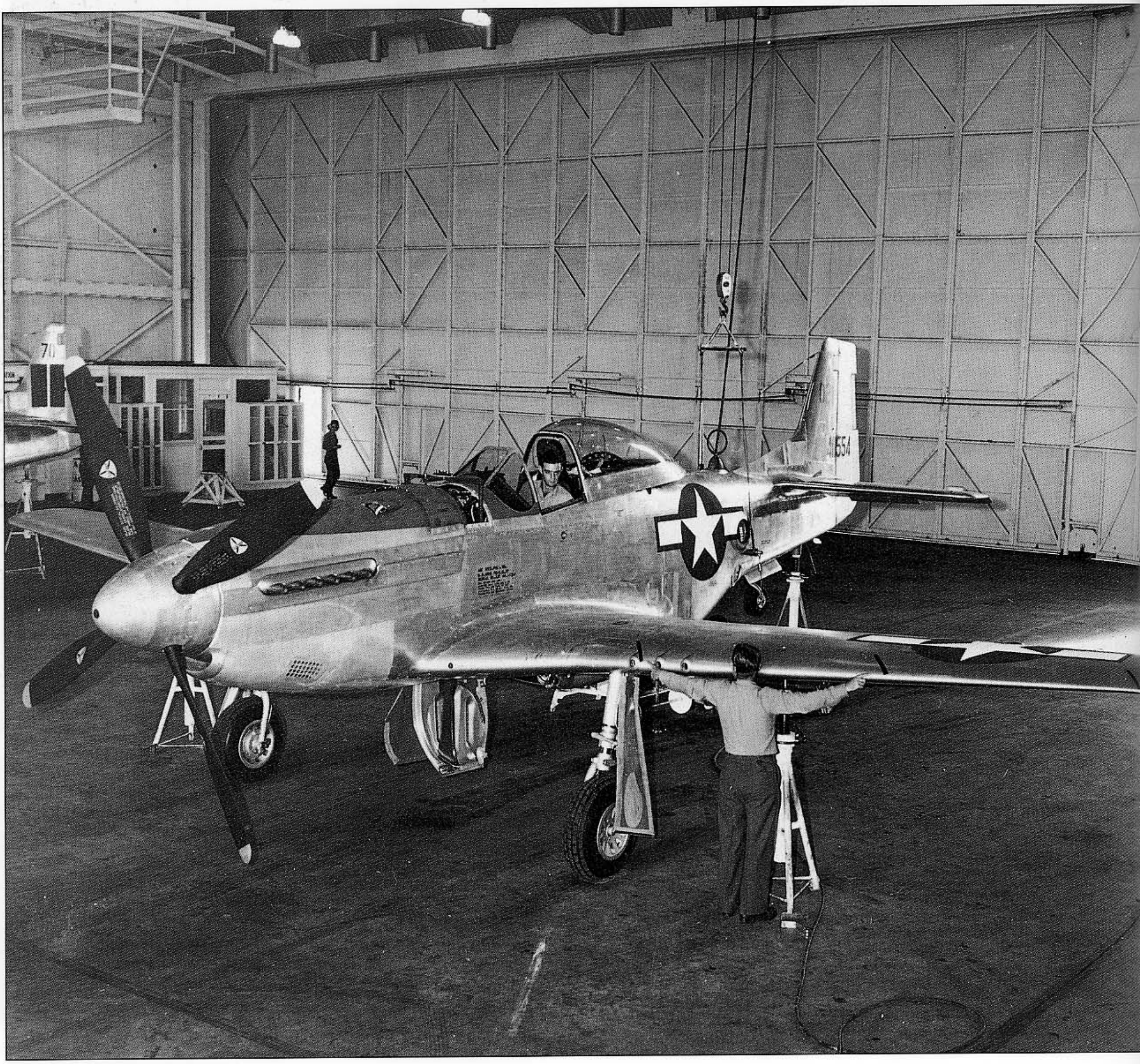
NAA tested out a laminated wooden model with a bubble canopy in the tunnel and found that such a modification would be perfectly acceptable. The disturbed air flowing from the bubble did not adversely effect the tail surfaces, but the removal of the upper portion of the fuselage did result in a loss of keel, and the engineers felt that the bubble top Mustang would be even more directionally unstable than earlier variants.

P-51B-1-NA s/n 43-12102 (the tenth such aircraft) was pulled from the assembly line and moved to the experimental shop, where it was redesigned from the windshield back to accommodate the bubble canopy and cut-down rear fuselage. Fuselage forgers were redesigned and built to create the sleek fuselage, and test pilot Bob Chilton pronounced the new modification very effective. This lead to two B-models being yanked from the production line (the 201st and 202nd P-51B-10-NAs) to be utilised as engineering test units for the new version of the Mustang – the NA-106, or P-51D.

Beside the bubble canopy, the new variant would have numerous other changes. The cowling was slightly revised, as was the wing structure in order to accommodate two extra .50 cal Brownings and the landing gear geometry was also modified. The fuselage fuel tank was installed in all Ds, and the V-1650-7 powerplant was fitted as standard. The 'Dash 7', as it was

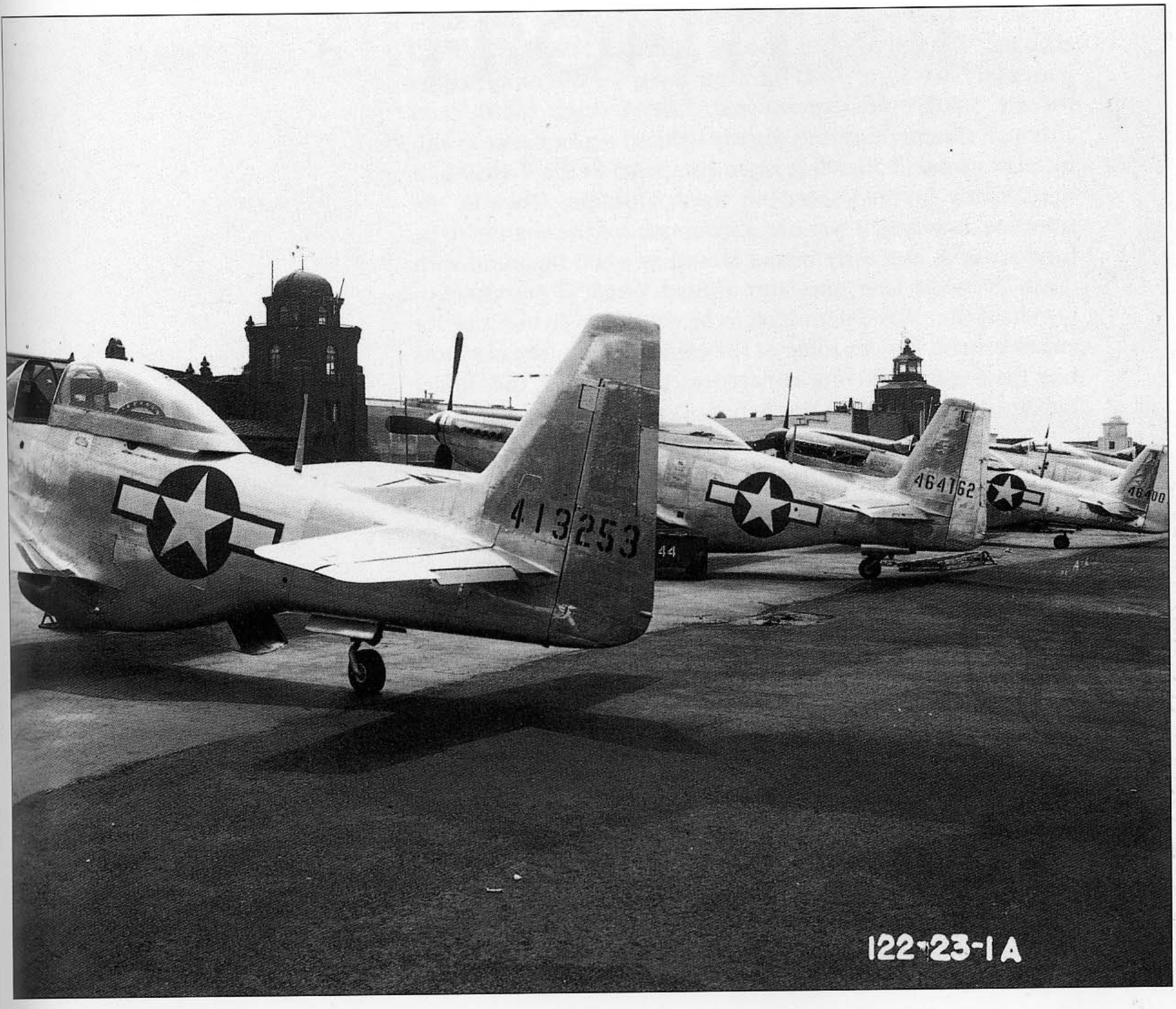
BELOW F-6K 44-11554 has the sighting area for its oblique camera checked out in a Dallas hangar (note the sighting markings painted in black on the upper surface of the wing leading edge). This aircraft is fitted with a four-blade Aeroproducts A-542-A1 Unimatic propeller which had a diameter of 11 ft

RIGHT Mustangs being readied for a day's test flying before being delivered to the USAAF. By 1945 the price of a complete Mustang, including government furnished equipment (GFE), had dropped to a remarkable $50,985 – or $3.59 per pound, which compared very favourably to the Bell P-63 Kingcobra at $6.74 per pound



ABOVE This is why the Axis powers could not win the war – over 130 P-51D Mustangs are parked in the early morning mist at Inglewood as they wait for flight testing. American mass production techniques became the world's most efficient during the war. Even though the Mustang was one of the simplest wartime fighters, the aircraft comprised over 36,000 parts held together with 25,000 rivets, and these totals did not include 300 GFE items

AAF.SPEC.PROJ.NO.92752-N
U.S.ARMY P-51D-5-NA
SERIAL NO. AAF 44-13962
CREW WEIGHT 200 LBS.
SERVICE THIS AIRPLANE WITH
GRADE 100/130 FUEL. IF NOT
VAILABLE T.O. 06-5-1 WILL BE
ONSULTED FOR EMERGENCY ACTION
UITABLE FOR AROMATIC FUEL



LEFT An NAA worker hands the Maintenance Inspection Record to a USAAF ferry pilot prior to P-51D-5-NA 44-13962 departing its Inglewood birthplace forever

ABOVE While P-51D production was phasing into the lightweight P-51H, trialling was still going on in order to find ways of improving the Mustang's less than adequate directional stability. Note that P-51D 44-13253 (the first D-5-NA) has here been fitted with a metal rudder and increased vertical fin, along with an experimental dorsal fin. Behind it, P-51H 44-64162 (the third H-model) wears an early style vertical tail before the unit was increased in height. This aircraft is followed by P-51D-20-NA 44-64001, with a standard D-model vertical tail and dorsal fin commonly known, had its supercharger impeller gear ratios changed, which increased take-off power to 1490 hp and full power (at 8500 ft) to 1590 hp. Gear ratios for the supercharger became 5.802:1 (low speed) and 7.349:1 (high speed), and although this modification slightly reduced performance at altitudes in excess of 25,000 ft when compared to the V-1650-3, it significantly boosted speeds at lower altitudes. Once in the frontline, however, it was not uncommon for the engines to be interchanged, and early model Mustangs could be found with 'Dash 7s' while later ones also utilised V-1650-3 powerplants. Overhaul time was determined to be 300 hours flying time for either variant. Besides some of the earlier aircraft, the elevators had their fabric covering replaced with metal, but the rudder remained fabric-covered throughout D-model production.

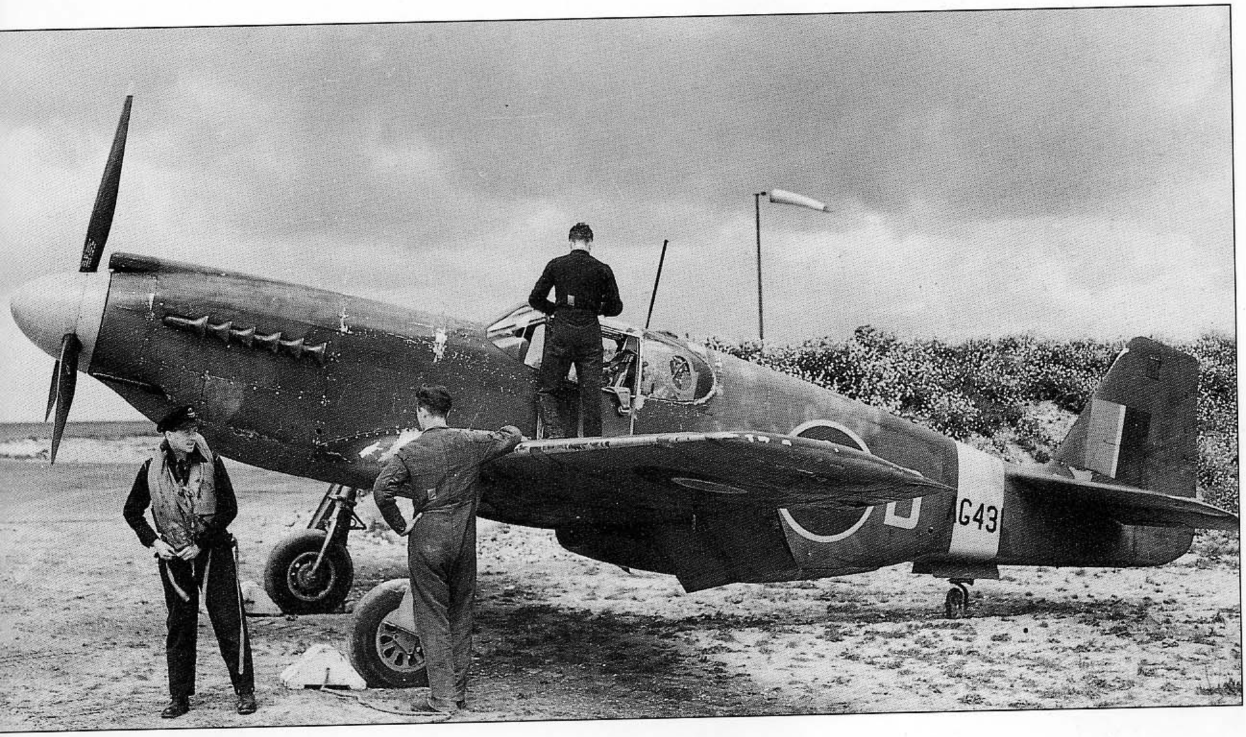
Some attention was also paid to improving the P-51D's aileron effectiveness, with seals being attached to the aileron's balance strip's leading edge. This modification worked very well, allowing pilots' to lessen the stick forces required to manoeuvre the fighter, particularly in combat. The structural integrity of the ailerons was also improved through the employment of three hinge bearing attachments rather than two.

With the addition of two extra Browning M2 weapons, the P-51D could tote 1840 rounds of ammunition, divided into 400 rounds for each inboard weapon, while the centre and outboard .50s had 260 rounds apiece. Capable of firing 800 rounds per minute, the M2 had a muzzle velocity of 2810 ft per second, with a maximum range of 7200 yards, but the effective combat range was about 800 yards maximum. The early P-51B/Cs had lots of armament problems since the weapons were installed at a rather extreme side angle to allow feed chutes easy access from the ammunition trays, but this caused jams due to casings and links becoming entangled in the feed belts. Further snags were encountered with the weapons' oil and grease lubricant, which would often congeal at rarified operational ceilings despite being fitted with heaters (the latter were usually only actuated near the combat area). These major problems were rectified by repositioning the weapons and issuing instructions to pilots to turn the heaters on after the weapons had been charged.

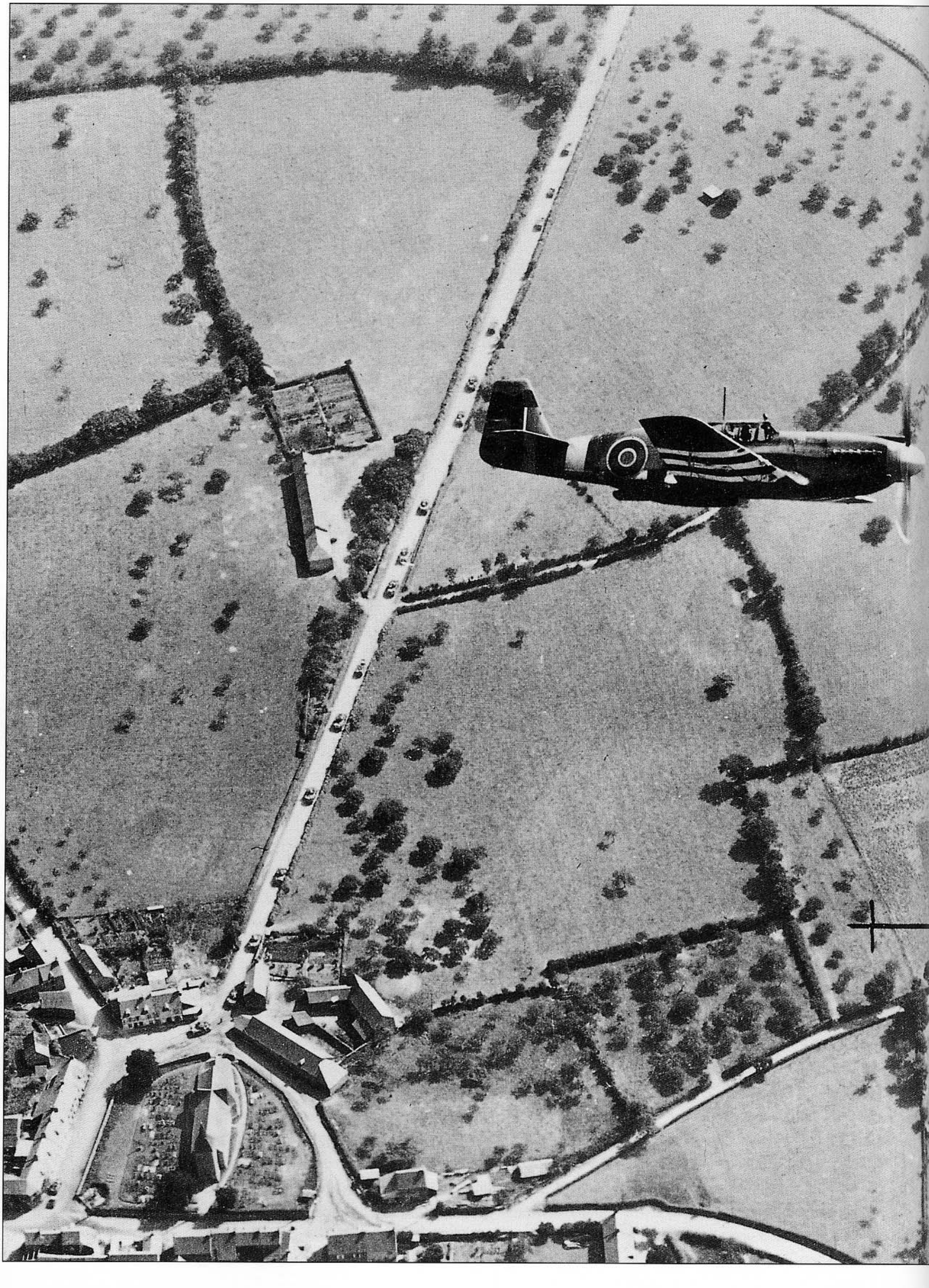
The D-model Mustang was to be the 'shining light' of NAA's wartime production, the Inglewood plant alone constructing 6502 D-NA fighters. This tally included an early order for 100 P-51D-1-NA aircraft to be supplied unassembled to Australia, and, oddly, the first four aircraft of this order were designated as Ds, although they had the old style built-up canopy! The Dallas factory would go on to contribute a further 1600 D-NT Mustangs to the over all total, a number which included 136 aircraft converted into F-6D photo-recon platforms. The Dallas-built P-51K was similar to the D-model but featured an Aeroproducts propeller, and 1500 of these machines were also completed. By any standard, the P-51D was a resounding production, as well as combat, success.

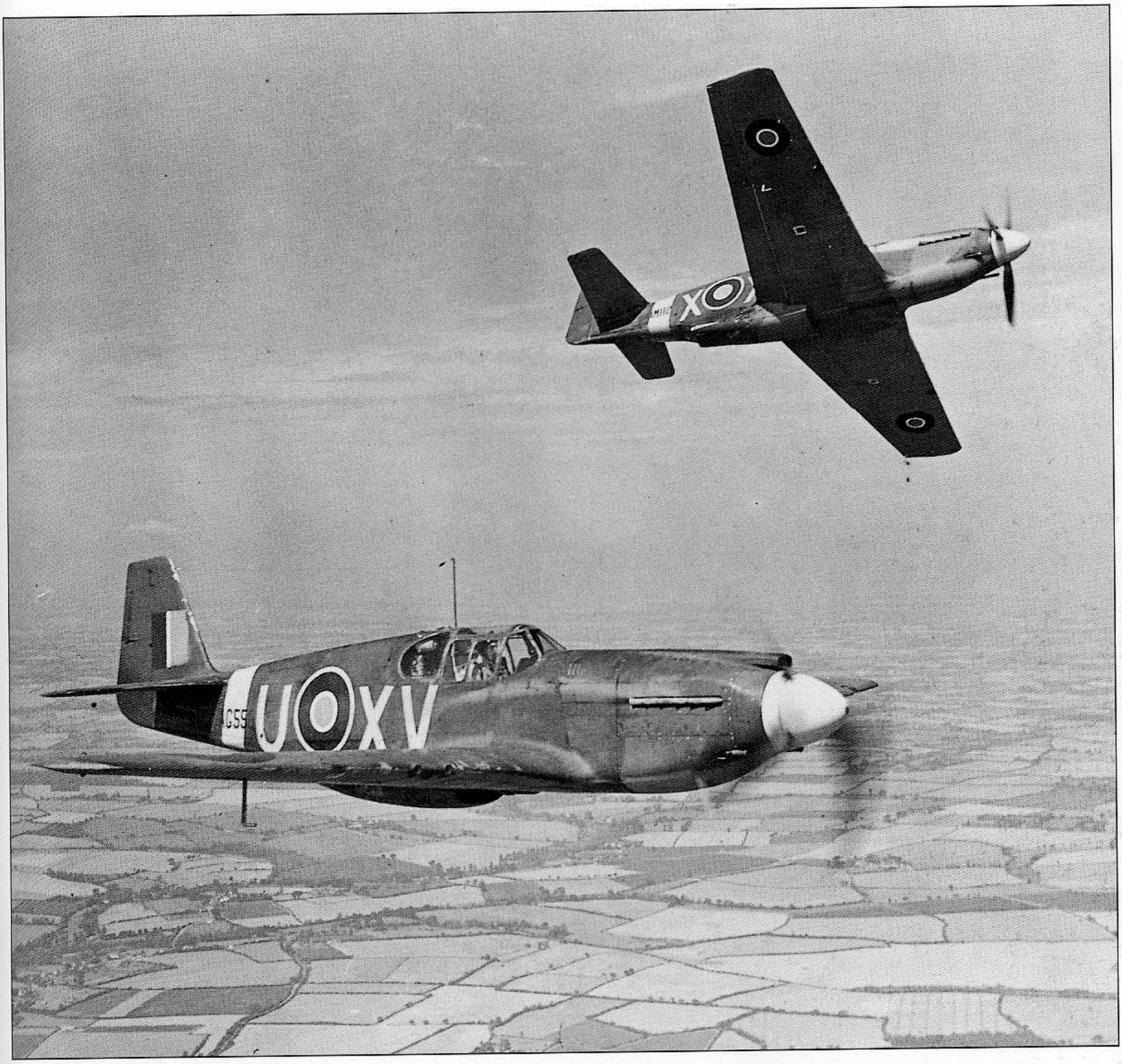
CHAPTER 6

FRONTLINE



There is a misconception that the Allison-powered Mustangs were something of a failure in frontline service. In the environment for which it was designed (low to medium altitudes), the Allison Mustang was respected by its adversaries, and the fact that these aircraft served through the entire war is an indication of their success. With the wind sock sticking out almost horizontally, Flg Off D W Samson, an Australian from Adelaide, and his groundcrew prepare Mustang I AG431 for a mission on 3 June 1943. As can be seen, the aircraft's paint has weathered and chipped from intense operations. Note also the barrels for the .50 cal machine guns protruding from the cowling above the pilot's head, and the opening cut into the rear vision panel for a crude, but effective, camera port. Ass-igned to No 16 Sqn when photographed, AG431 was converted into a maintenance training airframe during October 1943, with the serial 4225M. It is interesting to note that the RAF got an average, and amazing, engine life of 1500 hours with the V-1710-39 – three times the life of the average Merlin. Also, the British did away with the automatic boost control, resulting in a great increase in lower level performance with no apparent ill effects – operating at full throttle (72 in Hg) at sea level for over 20 minutes without damaging the engine



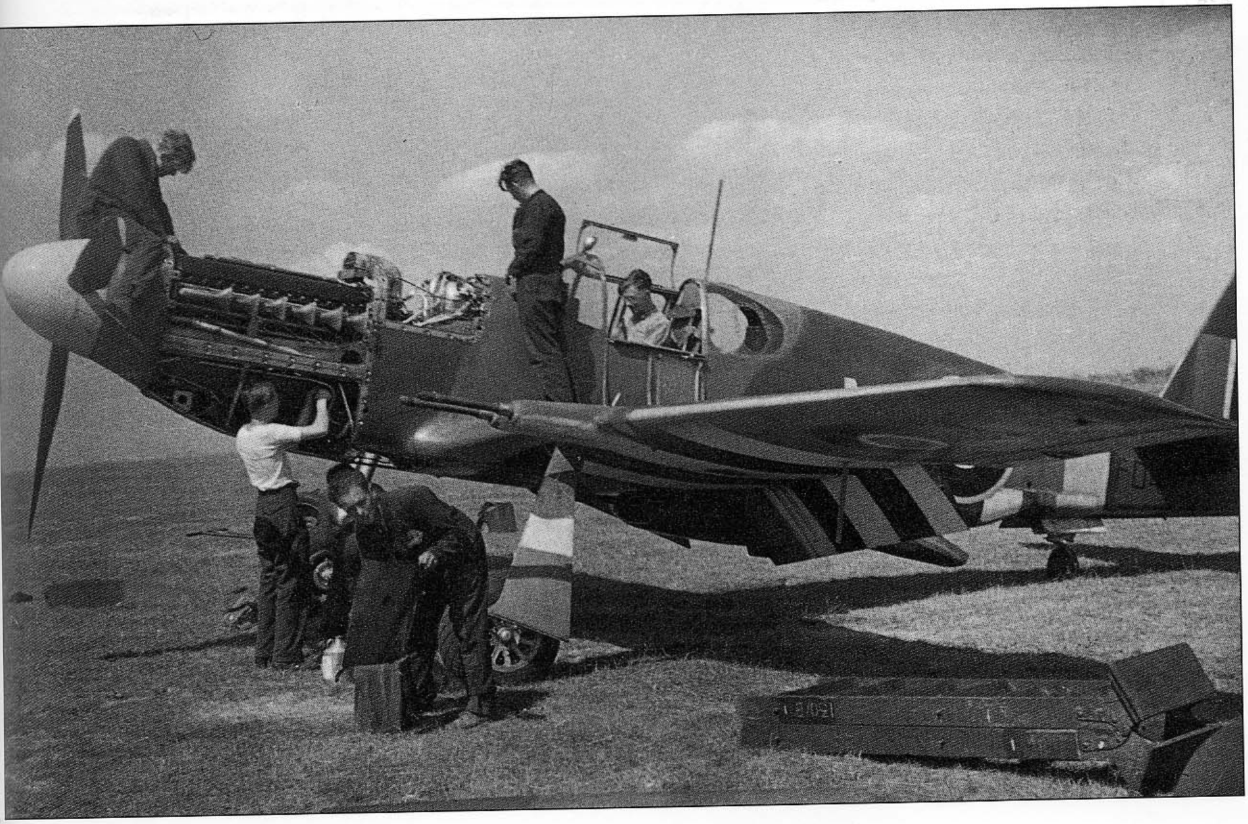


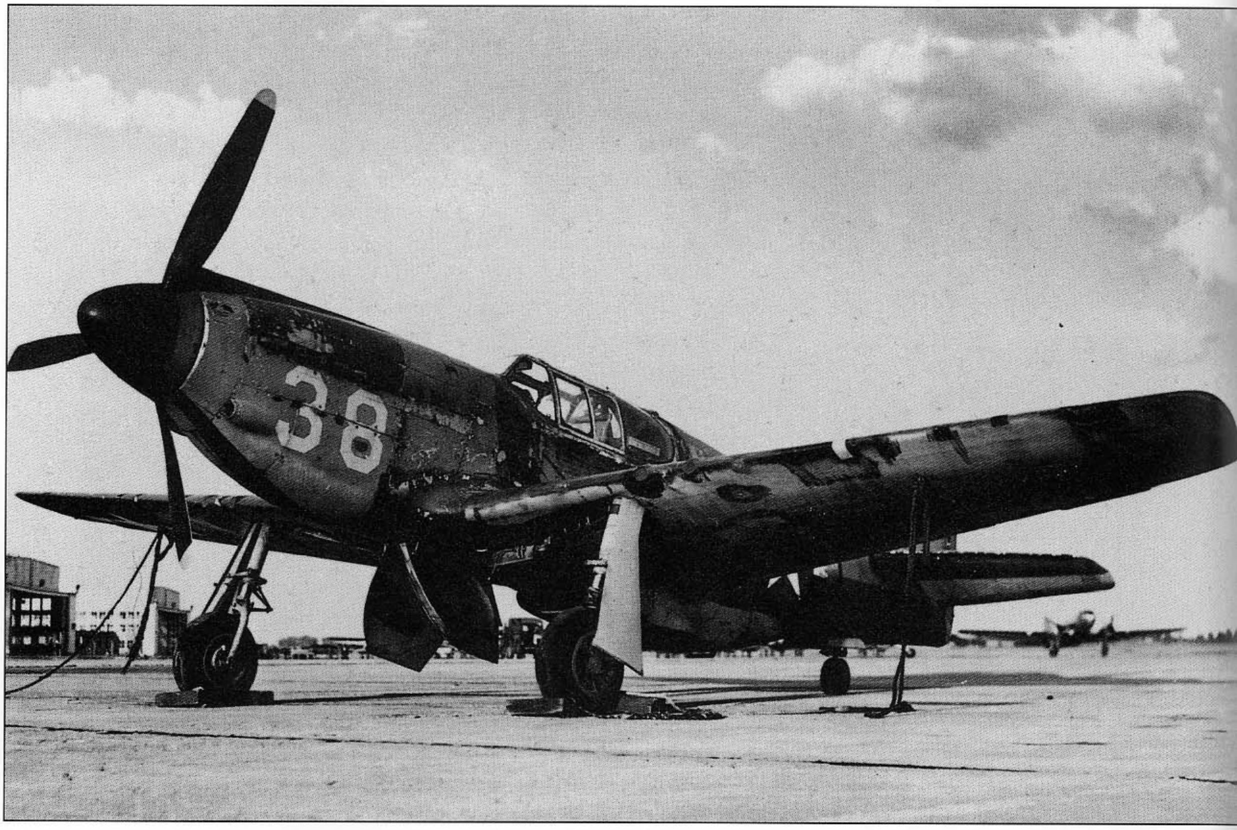
LEFT Mustang I in its element – down low and banking to utilise the F.24 camera mounted behind the pilot. With his aircraft finished in D-Day markings, the pilot is recording a stream of Allied tanks moving through the village of Conde-sure-Noireau following the successful Allied invasion (and photographed from another Mustang I). Tac-recon missions were called 'Rangers', and whilst one pilot would take photos, another would act as escort ('weaver'), keeping a lookout for German fighters while the other pilot concentrated on taking the photos

ABOVE Two No 2 Sqn Mustangs – AG550 is nearest the camera and is an NA-73 from the first batch of RAF Mustangs, while AM112 is an NA-83 from the second batch. AG550 crashed into a hill near Kimmeridge, Dorset, while flying in fog on 26 May 1943 and AM112 was damaged by flak on 3 August 1944 and crash-landed at forward airfield B8. No 26 Squadron at Gatwick, in Sussex, began receiving Mustang Is for operational trials during January 1942, completing an intensive two-week work-up at Weston Zoyland. In March 1942 No 241 Sqn received Mustangs, followed by Nos 16, 268 and 613 Sqns in April. No 2 Sqn at Sawbridgeworth also received Mustang Is in April 1942, commencing operations in July. The Mustangs were a marked improvement over the squadrons previous equipment, namely the ungainly Lysander and outclassed Tomahawk

ABOVE A rather pastoral view of tac-recon Mustangs in their element at a forward airfield following the invasion of France. The pilots are relaxing between missions, enjoying a game of cards, reading and writing letters home. After evaluating the type, Wg Cdr Ian Campbell-Orde mad the following comments on 5 May 1942 about the aircraft's equipment requirements for operations from forward bases; 'It is thought that little extra equipment would be required for operating the Mustang from a forward base. The radiator, however, picks up mud easily on a muddy aerodrome, and water under pressure is required for removing it successfully. It has the benefit of having three good methods of starting – by external battery, by internal battery and by hand inertia. It must be noted that the size of the forward base must be greater than the minimum necessary for contemporary types'

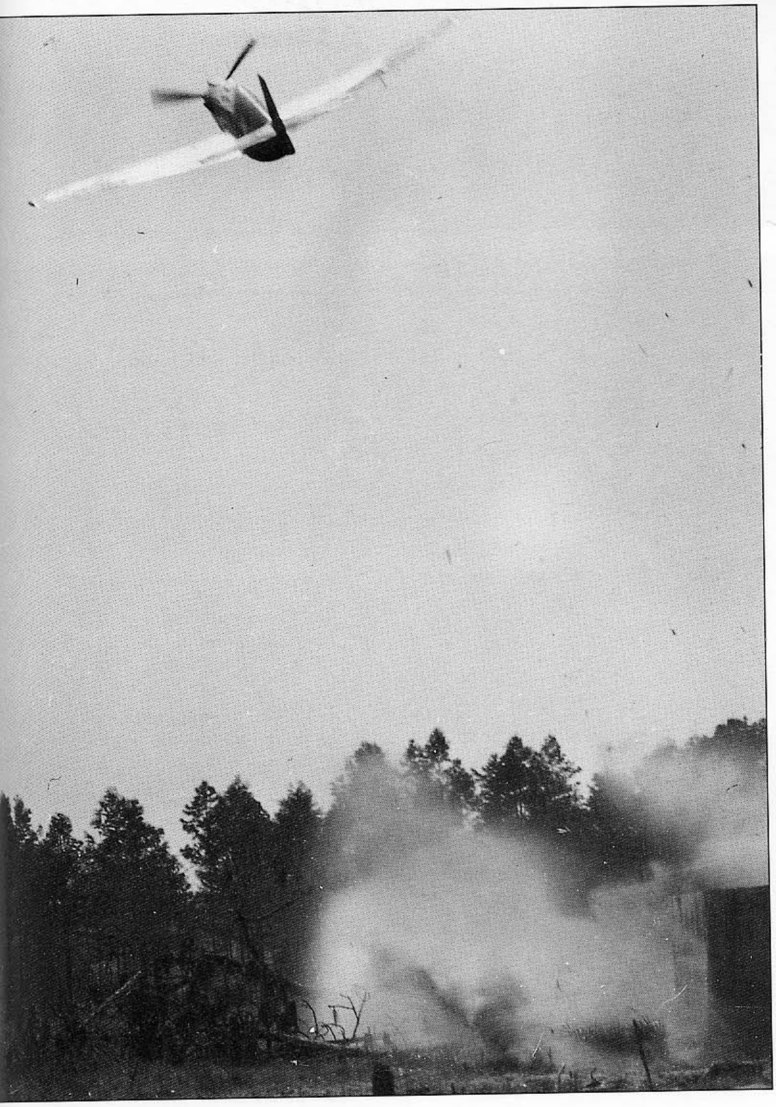
BELOW During June 1943 Army Co-operation Command was disestablished and the Mustang squadrons placed under the umbrella off the 2nd Tactical Air Force or RAF Fighter Command. The NA-91 was an improved Mustang I fitted with the powerful punch of four 20 mm cannon, and the British ordered 150 aircraft as the Mustang Mk IA – the type eventually equipped Nos 2, 63, 168, 170, 171 and 268 Sqns. However, with the attack on Pearl Harbor on 7 December 1941, the American government commandeered 55 of the aircraft, resulting in only 92 cannon-armed Mustang IAs reaching Britain for frontline service. Here, Mustang IA FD472 receives field maintenance at a forward airstrip during the Allied invasion of France. Note how the D-Day invasion stripes have been applied in a very neat manner, and even extend onto the fairings for the cannons. The 20 mm cannon was ideal for the tactical reconnaissance mission since it could easily destroy or damage armoured targets. Also, the weapon was in wide use on other RAF aircraft, which meant that serviceability in the field was quite good. Due to the fact that the initial delivery quantities were relatively small, and given the type's hard use and combat losses, it is not surprising that the numbers of in-service Allison Mustangs had rapidly declined by late 1944. At first it was thought that the Merlin-powered Mustang Mk III could be incorporated into the units with Mk Is, but there were too many operational differences between the two types. Not wanting to lose the long-range tac-recon coverage supplied by the Allison Mustangs, the surviving Mustang squadrons were stripped down to operate with bare essentials from primitive airfields prior to the invasion of France. A Mustang squadron nucleus was built around the commanding officer, adjutant, pilots, aircraft and a mobile airfield team, which was responsible for maintaining and fuelling the aircraft, along with providing for the needs of squadron personnel. The hard-pressed Mustangs provided sterling service before, during and after the invasion. FD472 was serving with No 268 Sqn when it was struck off charge on 30 September 1944, probably as the result of battle damage



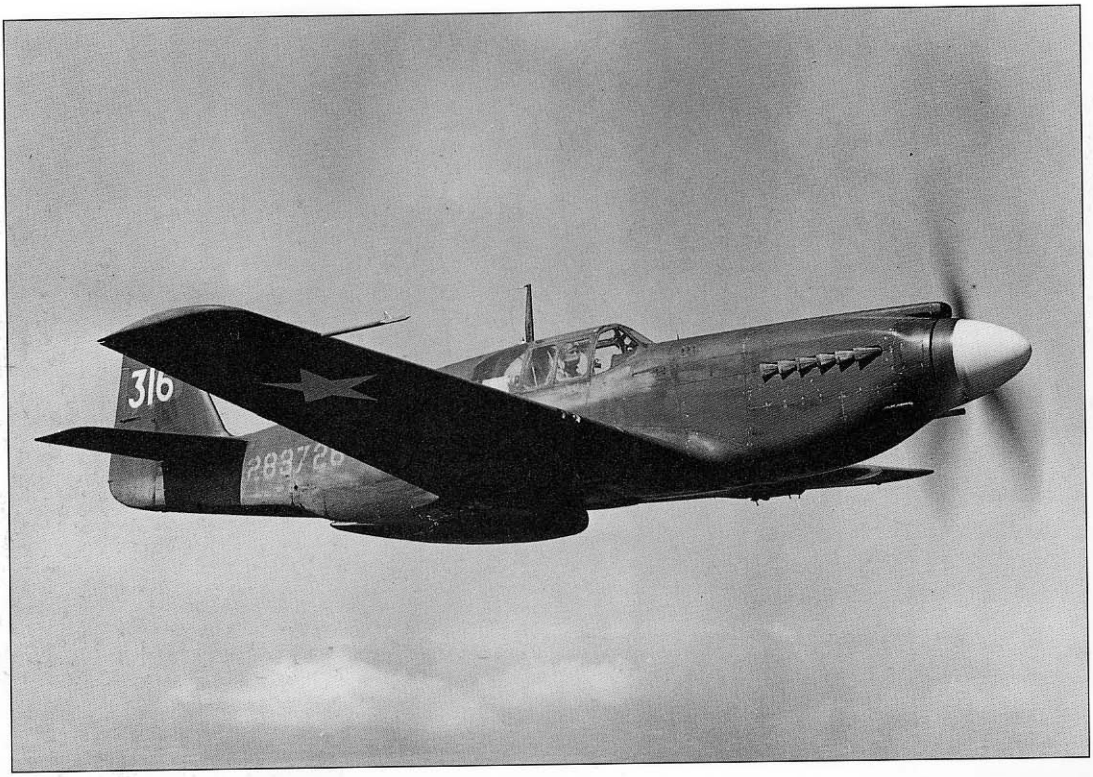


ABOVE Numerous coats of paint and extremely heavy weathering disguise the importance of this aircraft – XP-51 USAAC s/n 41-038. As part of the original contract with the British, the fourth and tenth NA-73 Mustang Is were taken from the initial production batch and supplied to the Army Air Corps for further testing to see if the aircraft warranted production. Robert Chilton took XP-51 '038 aloft for the first time on 20 May 1941 but, for various reasons, the fighter did not get to Wright Field for extensive testing until 24 August 1941, followed by XP-51 USAAC s/n 41-039 on 16 December. Most of the testing was done with '038, as '039 suffered from a number of problems, and the former was eventually transferred to NACA at Langley Field, Virginia, where it was used for high-speed flight testing. The aircraft had been scheduled for delivery in February/March 1941, and Gen Hap Arnold would later comment, 'That we did not have it (the Mustang) sooner was the Air Force's own fault'. When photographed, '038 was in storage at Freeman Field, Indiana, for a proposed national air museum. The aircraft was eventually stored at the Smithsonian's Silver Hill facility until transferred to the Experimental Aircraft Association in the late 1970s. Here, it was magnificently restored by Darrell Skurich and flown for several years, until placed on display in the EAA Museum

OPPOSITE TOP Filthy, and decidedly tired looking in appearance, a 27th Fighter Bomber Group (FBG) A-36A takes a break for a snap shot with its groundcrew at Gela, Sicily. Note bombs under the wing and the barrels of the .50 cal machine guns protruding from the lower cowling. The latter also records 150 combat missions (98 dive-bombing, 42 strafing and ten armed recon), while the spinner has been painted red and a blue surround had been recently added to the national insignia. Individual aircraft letter 'A' was applied directly over the aircraft's serial. The odd looking splotch atop the fuselage immediately behind the canopy was a poison gas detector patch. Operating from forward airfields, A-36As inflicted tremendous damage on frontline Axis forces



LEFT An A-36A pilot performs a low pull out after blasting a target during a stateside training exercise. Extra strengthening was added to the wing and dive brake area to enable the two-foot wide brakes to open during a dive, effectively reducing the airspeed to around 390 mph. The 27th FBG found that the aircraft was very effective in the dive-bombing role when the dive was entered at 90° from an altitude of around 8000 ft – during these dive attacks, up to 20 A-36As would hit an enemy target. In some vintage North American advertisements, the A-36A was called the 'Invader', but this was never an official name. Lt Robert Walsh of the 27th FBG, stated, 'why don't we call them Invaders, since we're always invading places?' The name certainly stuck with the pilots that were flying the aircraft. Commanded by Lt Col John Stevenson, the 27th FBG entered combat by blasting the island of Pantelleria (A-36As flew 1000 missions during 35 days) during April 1943. The Twelfth Air Force fielded the 27th and 86th FBGs, the latter being the first to go overseas in March 1943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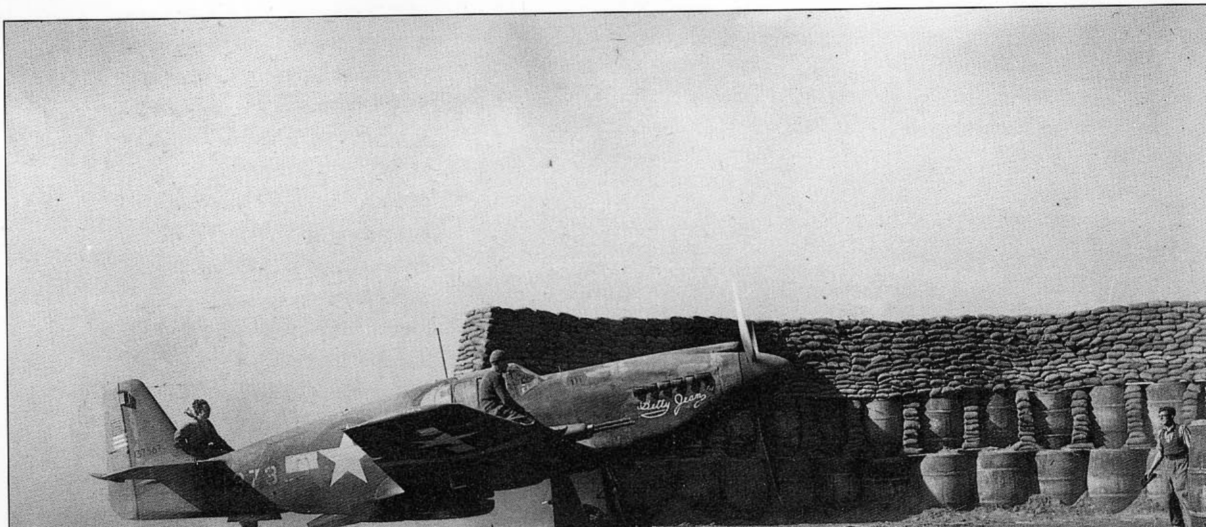
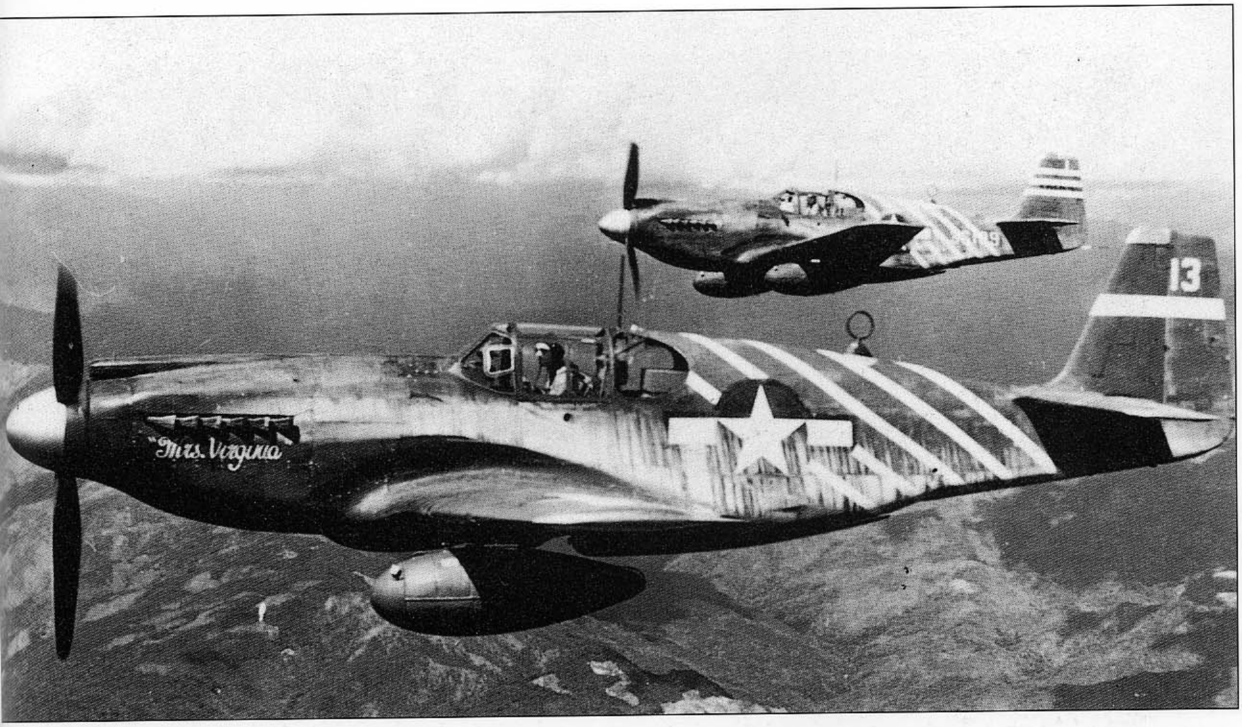
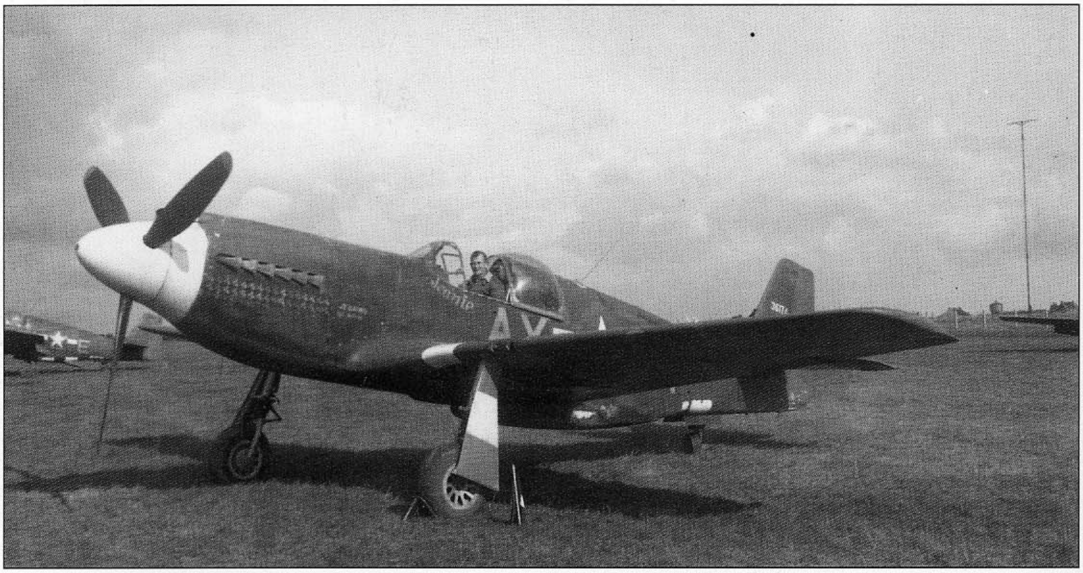

"Betty Jean"

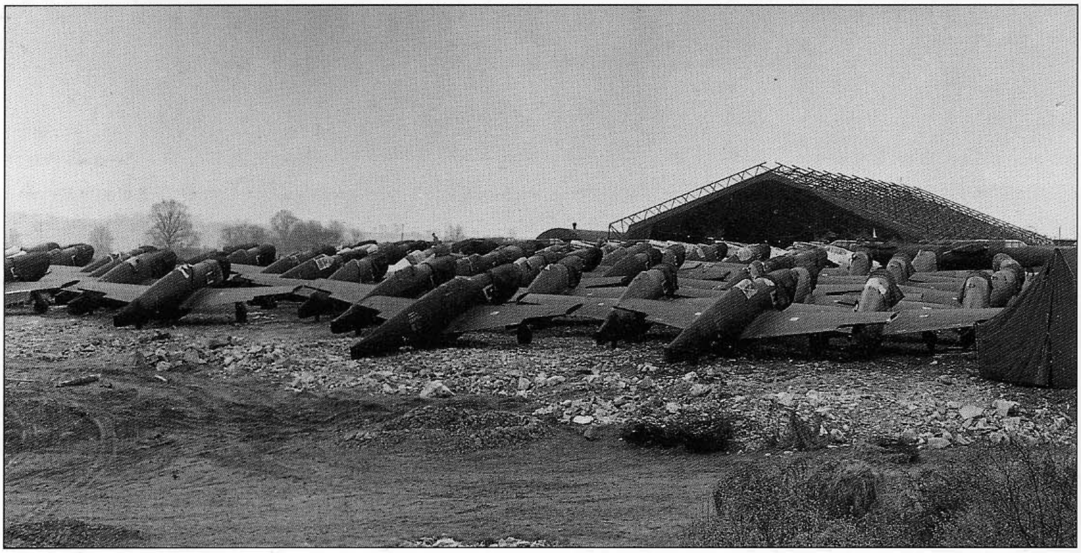


OPPOSITE TOP Not an overly photographed aircraft (probably because most of them were assigned to remote and hotly contested forward combat areas), this fine aerial portrait of A-36A-1-NA USAAF s/n 42-83726 was taken at a stateside training base (Waycross, in Georgia), indicated by the code painted on the vertical tail. Note the heavy exhaust staining from the Allison V-1710-87, denoting that the engine had been operating at high power settings. The dive brakes made the repositioning of the pitot tube necessary, and this unit was installed on the right outer wing panel. Besides the two .50 cals in the nose, the .30 cal wing guns were replaced with four .50 cals, giving the aircraft a very heavy punch. Finally, the bomb racks were installed closer to the gear legs in order to utilise as much structural strength as possible. A-36A pilots would go on to account for 84 enemy aircraft destroyed during aerial combat

OPPOSITE LEFT Its propeller churning up dirt, P-51-2-NA USAAF s/n 41-37367 is guided into a well-protected revetment on a field near the Anzio beach by its groundcrew during April 1944. The bottom of the revetment's blast wall appears to have been formed empty(?!) Italian wine barrels, with sand bags piled on top. Named *Betty Jean*, the Mustang is in very worn condition, with only part of the American flag remaining visible on the rudder. The national insignia on the fuselage has had its yellow identifier painted over in blue, and white bars have also been added, obscuring the serial which has been crudely repeated on the vertical fin

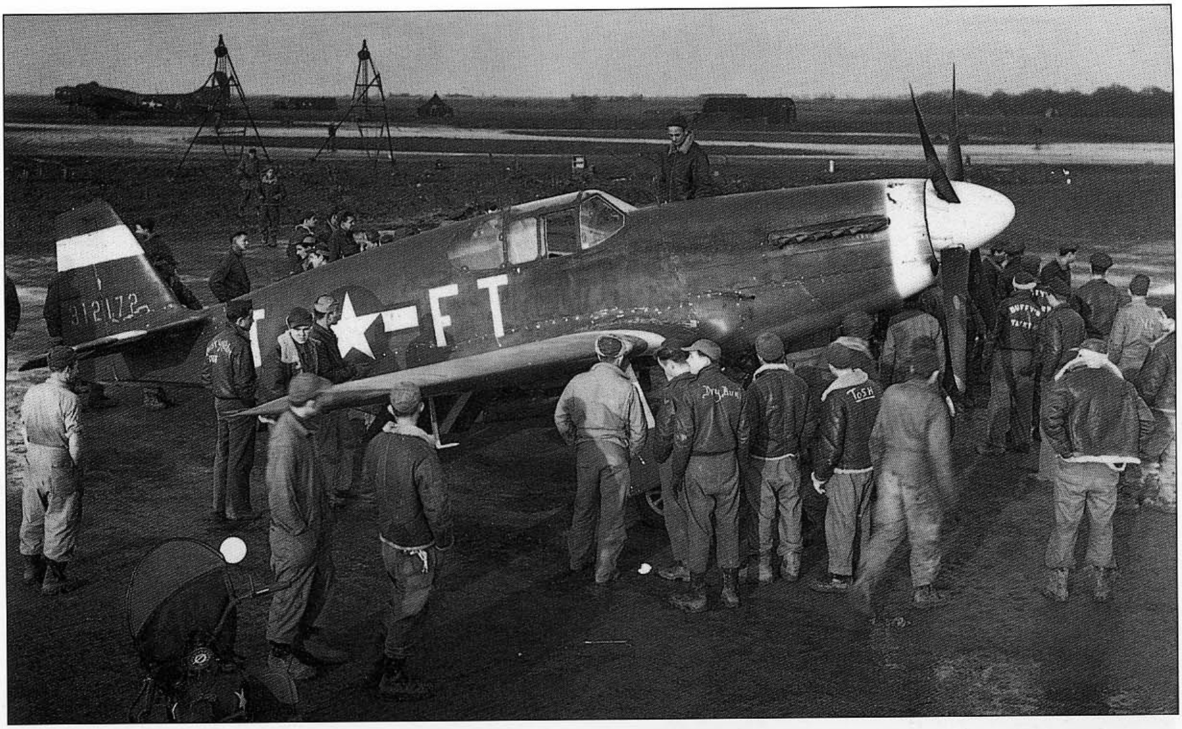
ABOVE P-51As equipped only three USAAF units – the 311th and 23rd FGs and the 1st Air Commandos (AC). The latter outfit adorned their P-51As with the distinctive five white stripes seen around the fuselages of these aircraft. Although operating in the rough conditions of the China Burma India (CBI) Theatre, the Mustangs, and their Allison engines, proved to be extremely rugged. Lead aircraft carries the name *Mrs. Virginia*, and note the heavy exhaust staining on both fighters. Forward portions of the spinners were left in natural metal. Seen near the Chin Hills, the second Mustang is being flown by Col Phil Cochran, who later became the character 'Flip Corkran' in the popular comic strip *Terry and the Pirates*

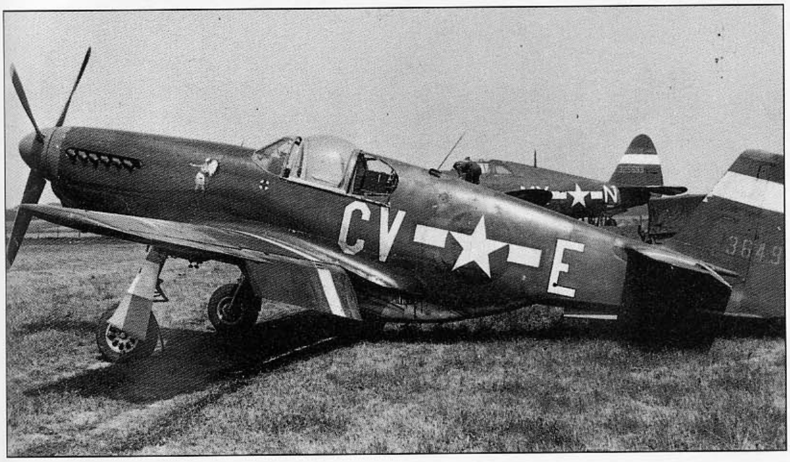




TOP USAAF s/n 43-6174 was originally built as one of 155 P-51A-10-NAs, but was converted to an F-6B photo-recon platform. When photographed at Le Molay, France, during August 1944, the aircraft (fitted with an English-designed Malcolm hood bubble canopy) was assigned to the 107th Tactical Reconnaissance Squadron (TRS), 67th Tactical Reconnaissance Group (TRG). Note the mission markers in the form of cameras on the cowling, the name *Jeanie* under the windshield, and the crudely applied white identification bands on the nose and wing. The D-Day markings under the fuselage are almost obliterated on this aircraft, although those on the F-6B in the background are still intact

ABOVE Getting the Mustangs to Britain was a major operation in itself. Aircraft being shipped by sea stood the considerable chance of having their transports torpedoed by U-boats. Minus their tails and carefully cocooned against the salt air and elements, these P-51Bs were photographed on 18 April 1944 at Filton in Britain. In the background can be seen further B-models in bare metal that have had their protective covering stripped off and are in the process of being prepared for flight. Also note the various Douglas A-20 Havocs squeezed in amongst the Mustangs, these aircraft having also arrived by ship

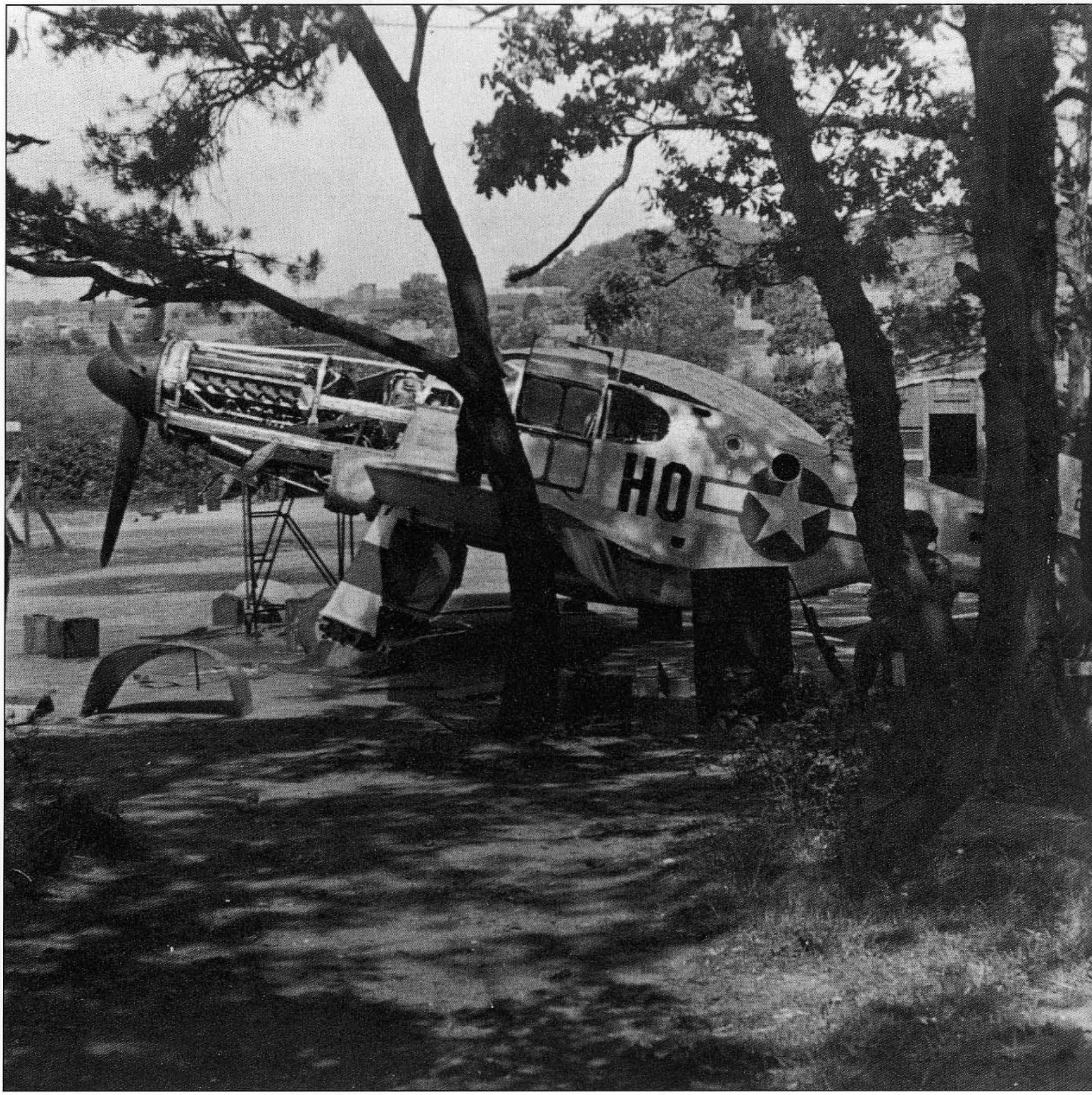


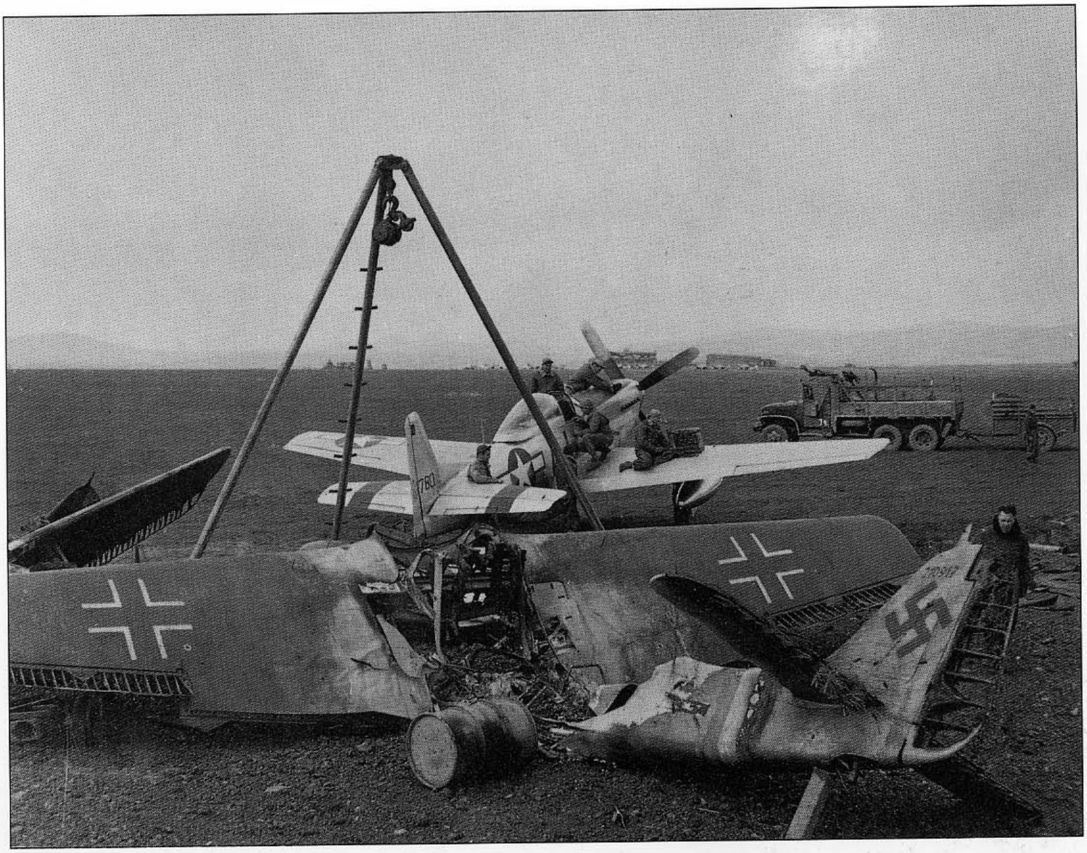


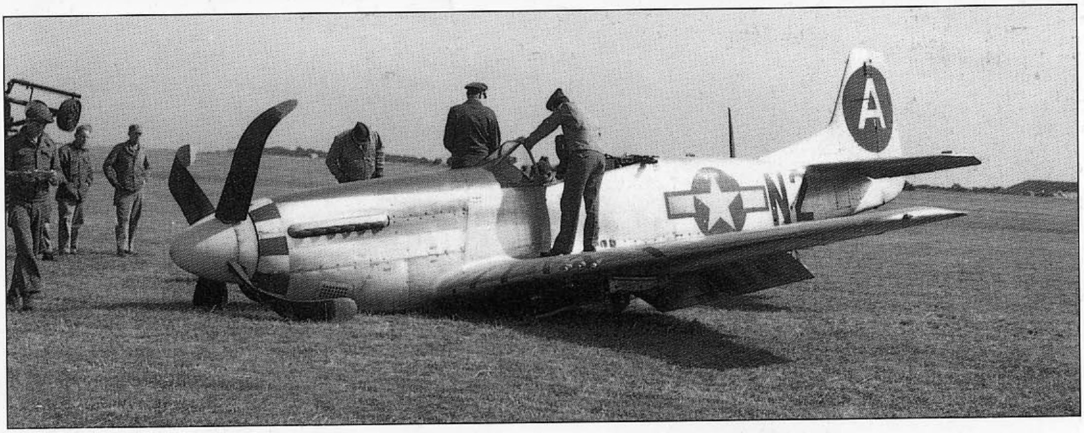
ABOVE P-51B-5-NA assigned to the 368th FS, 359th FG. The spinner and nose band of this aircraft have been painted in green squadron colours. Note the Malcolm hood, single victory marking under the windshield and personal insignia of an Indian girl with a bow and arrow

ABOVE Flying Fortress crews from the 401st BG (many of whom are wearing jackets with their aircraft's name painted on the backs) check over P-51B-1-NA USAAF s/n 43-12172, which landed at their Deenethorpe base on 27 December 1943. Assigned to the 353rd FS, the aircraft has had the white identification stripes roughly applied. In order to distinguish the aircraft from the Bf 109, the spinner was painted white and a similar coloured band 12 inches wide applied directly behind it. Another 12-inch band was applied around the vertical and horizontal tails, whilst and 15-inch bands were applied over and under the wing near the root. Being painted in the field, these dimensions often varied. The vertical tail band was discontinued or removed from camouflaged aircraft from 23 March 1944

BELOW Rural scene of a 487th FS, 352nd FG Mustang receiving in-depth maintenance. Since there is a soldier with a rifle sitting behind a tree immediately behind the national insignia, the aircraft was probably photographed at a forward field



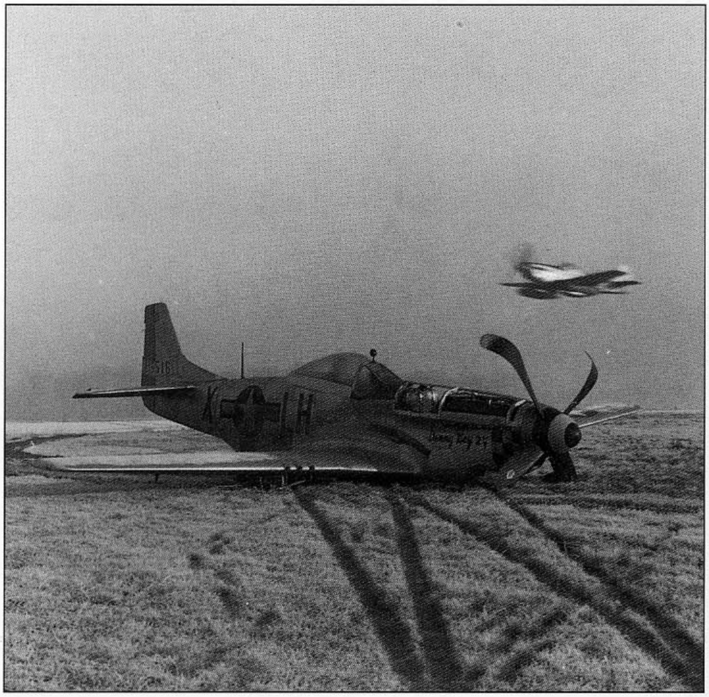


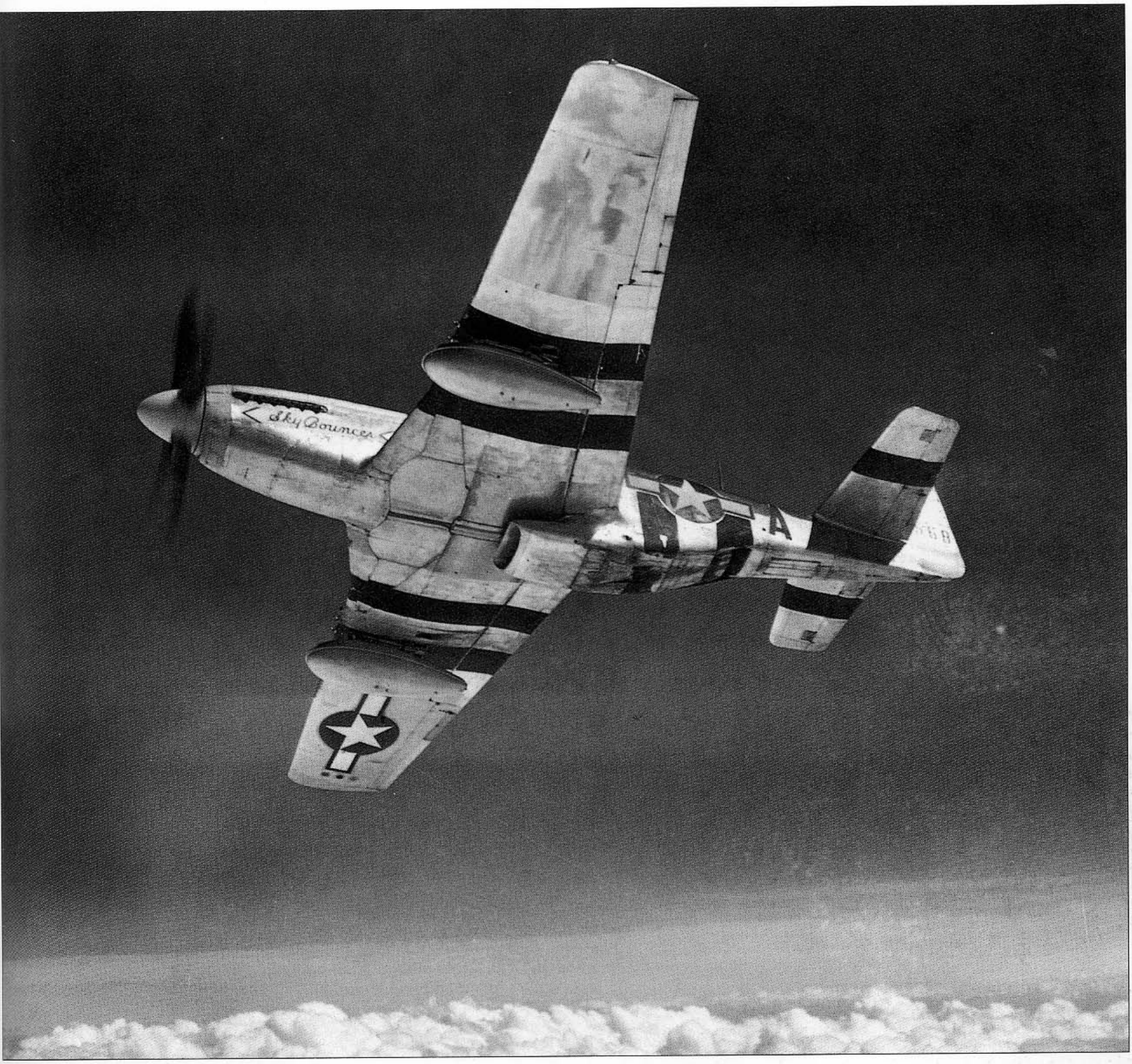


TOP Few photographs better express the P-51D's mastery over the once-vaunted Luftwaffe than this view of P-51D-20-NA USAAF 44-63780 of the 356th FS, 354th FG, parked next to burned-out Fw 190D Wk-Nr 210917 (note the Reich Defence bands painted on the rear fuselage). Mustangs from this unit were the first to arrive east of the Rhine and the aircraft is being serviced at Y-74, near Frankfurt, on 2 April 1945

ABOVE Classic Mustang belly landing. P-51D-10-NA USAAF s/n 44-14315 of the 383rd FS, 364th FG is seen being examined at Honnington on 18 June 1945. The individual aircraft letter is carried in a black circle on the vertical tail

RIGHT With cowling, landing gear and 110-gal long-range drop tanks scattered in trail, P-51D-15-NA USAAF s/n 44-15516 *Danny Boy 2nd* of the 350th FS, 353rd FG rests on its belly following a ground loop on take-off while other Mustangs launch for a mission to Germany on 29 December 1944





LEFT Some of the best Mustang photographs to come out of World War 2 were taking during one photo session conducted from a 91st BG Flying Fortress. Seen on 11 July 1944, the Mustangs were from the 375th FS, 361st FG, out of Bottisham, Essex. Lead Mustang is P-51D USAAF s/n 44-13410 *Lou IV*, flown by group commanding officer Col Tom Christian, who was killed in action in the aircraft on 12 August. First Lt Urban Drew was flying 44-13926 (destroyed on 9 August 1944 while being flown by Lt Don Dellinger) instead of his usual *Detroit Miss* (Drew was the Group's third-ranking ace), while Lt Bruce Rowlett was in 44-13568 *Sky Bouncer* and Lt Francis Glanker was piloting P-51B 42-106811. The Mustangs upper surfaces were given a hasty coat of Olive Drab when it was thought the aircraft would be immediately deploying to forward airfields in France in the wake D-Day

ABOVE *Sky Bouncer* breaks away from the 91st BG Flying Fortress, illustrating the lower surface D-Day stripes and drop tanks to advantage

PETIE 2nd
HO
M
414151

FIRE
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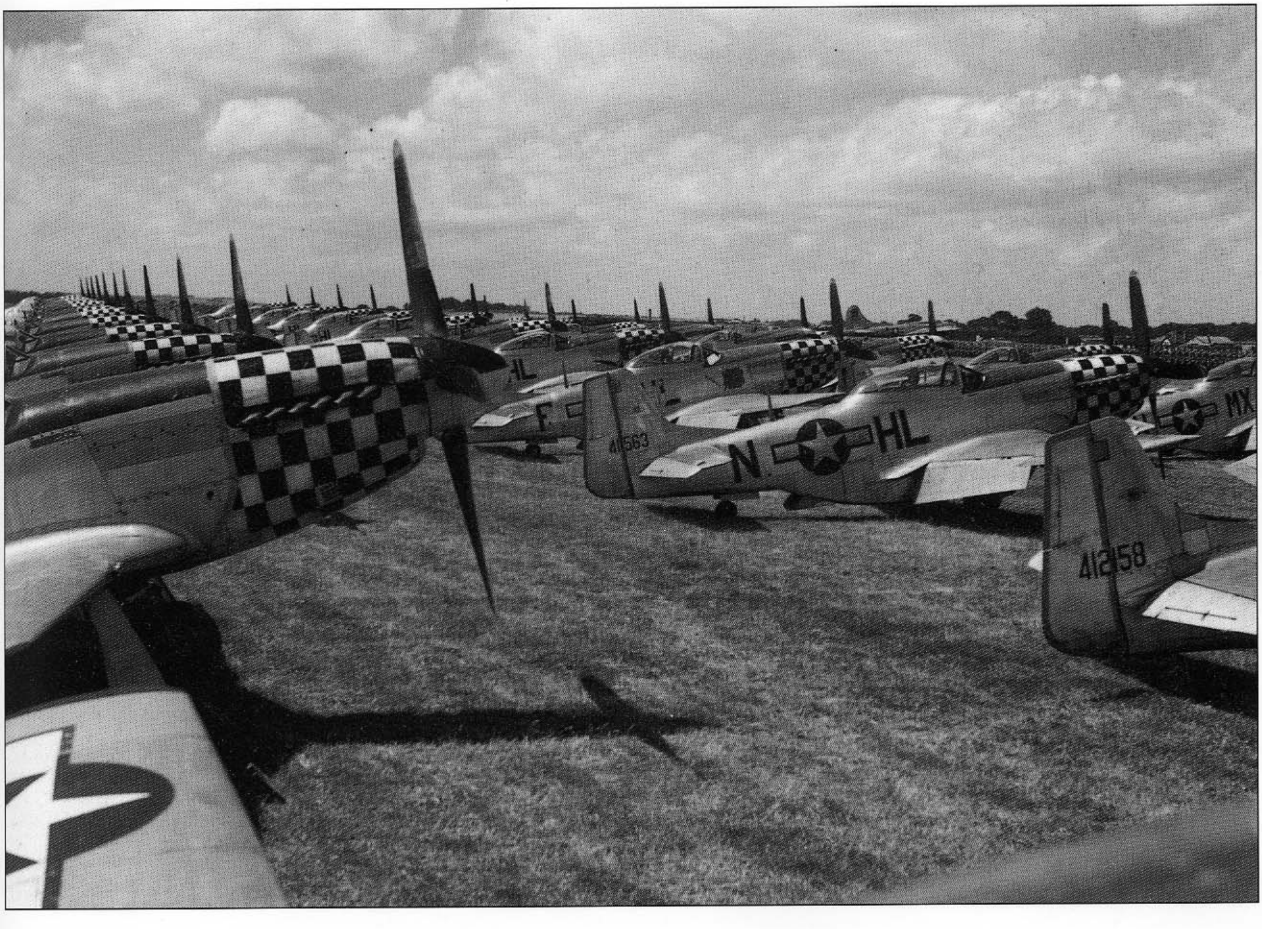
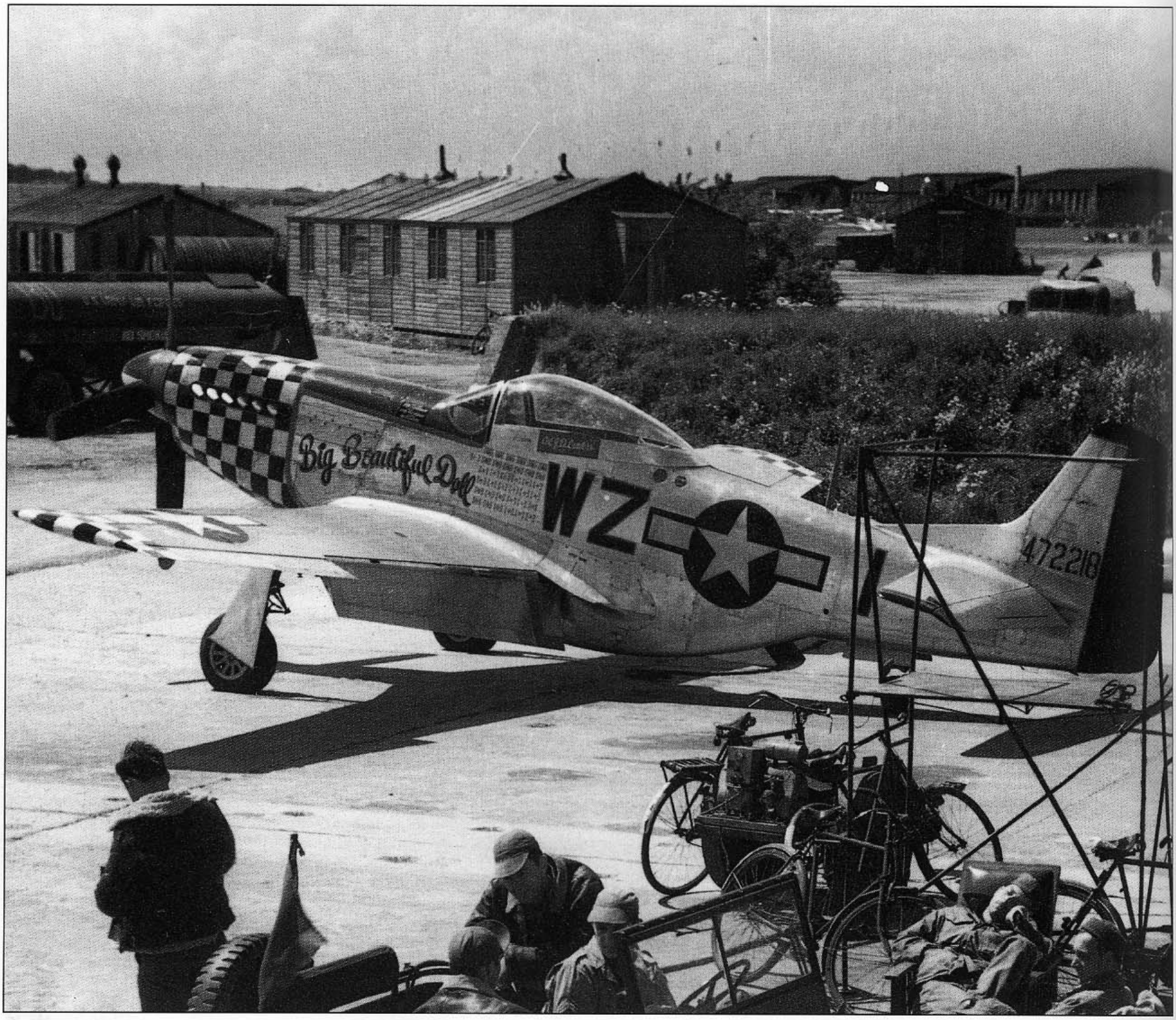
LEFT Parked on pierced steel planking, John Meyer's *PETIE 2nd* rests between missions. The aircraft wears the 'HO' codes of the 487th FS and the pilot's impressive scoreboard – when Meyer found out that the swastikas on his aircraft did not stand out in the air as well and the crosses carried by some of the other squadron Mustangs, he ordered his crew chief to put thick black outlines around the kill markings so that the Germans would recognise him in the air

OPPOSITE BELOW The pilot of P-51D USAAF s/n 44-14034 '5Y-J' died when his 384th FS, 364th FG Mustang crashed on landing and burst into flames at Honnington on 30 July 1944

BELOW Mustangs on parade. Photographed during a victory celebration on 7 June 1945, this view shows the unstoppable force of P-51s in Europe. Taken at the 78th FG's home field at Duxford, each row comprised an entire squadron. The 83rd FS fills the middle with their Dallas-built P-51Ks, while the other two units flew D-models




Big Beautiful Doll
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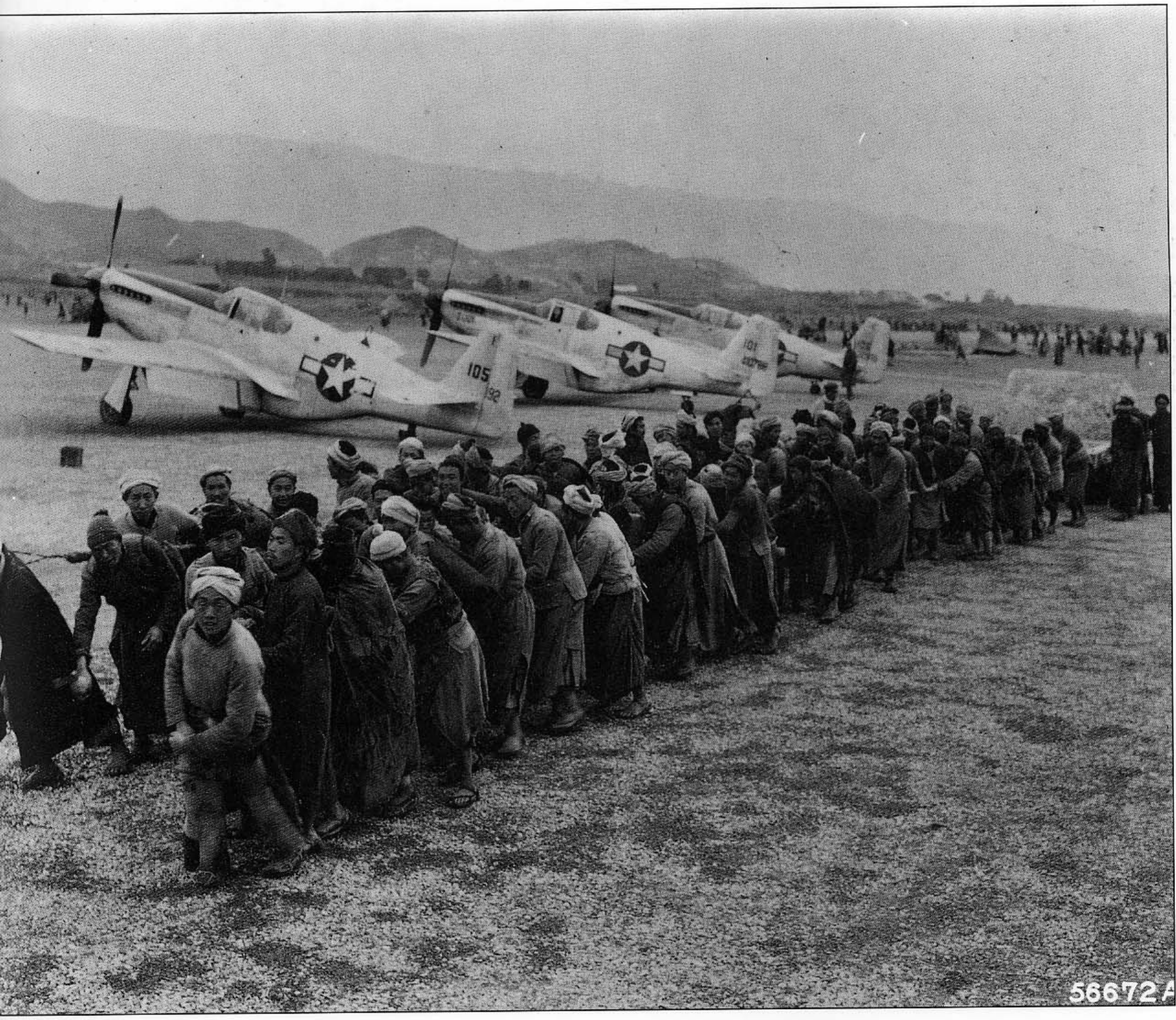
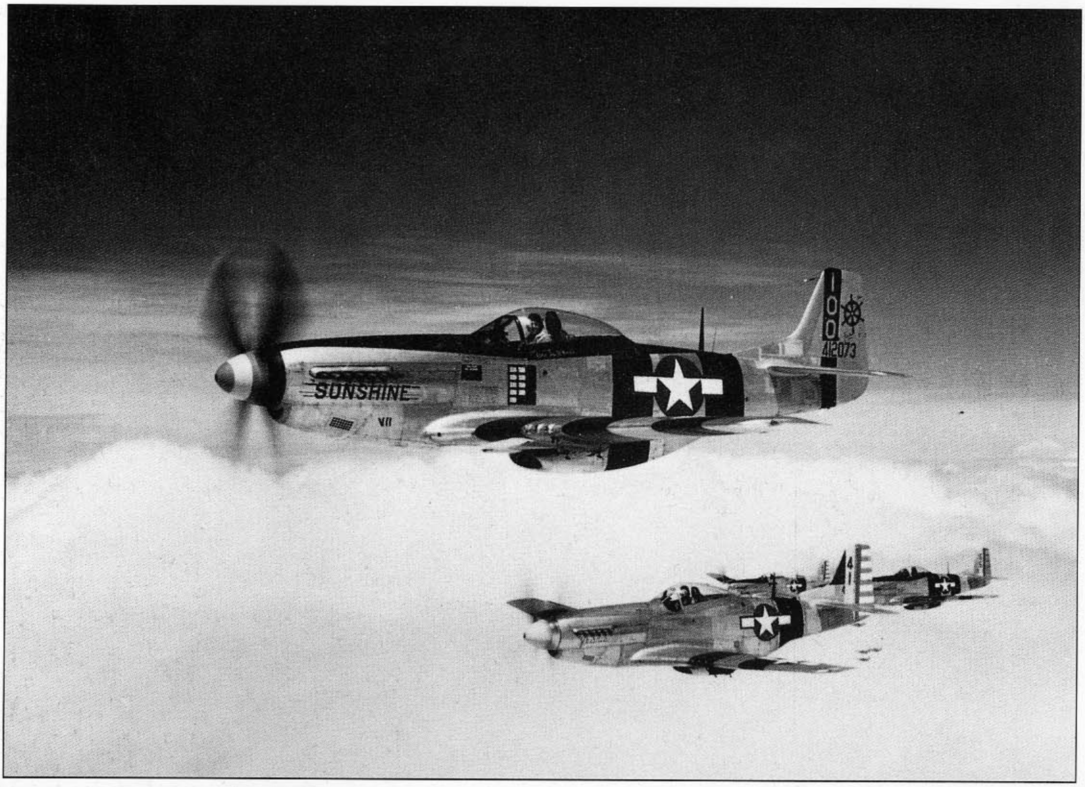
ABOVE Certainly one of the most attractive Mustangs, *Big Beautiful Doll* (P-51D-20-NA USAAF s/n 44-72218) was the personal mount of Col John Landers, commanding officer of the 78th FG. Landers was an ace in both the Pacific and Europe theatres

BELOW With bare metal Mus-tangs serving as a backdrop, Miao workers pull a ten-ton roller over the rough runway surface at Laohwangping airfield in China

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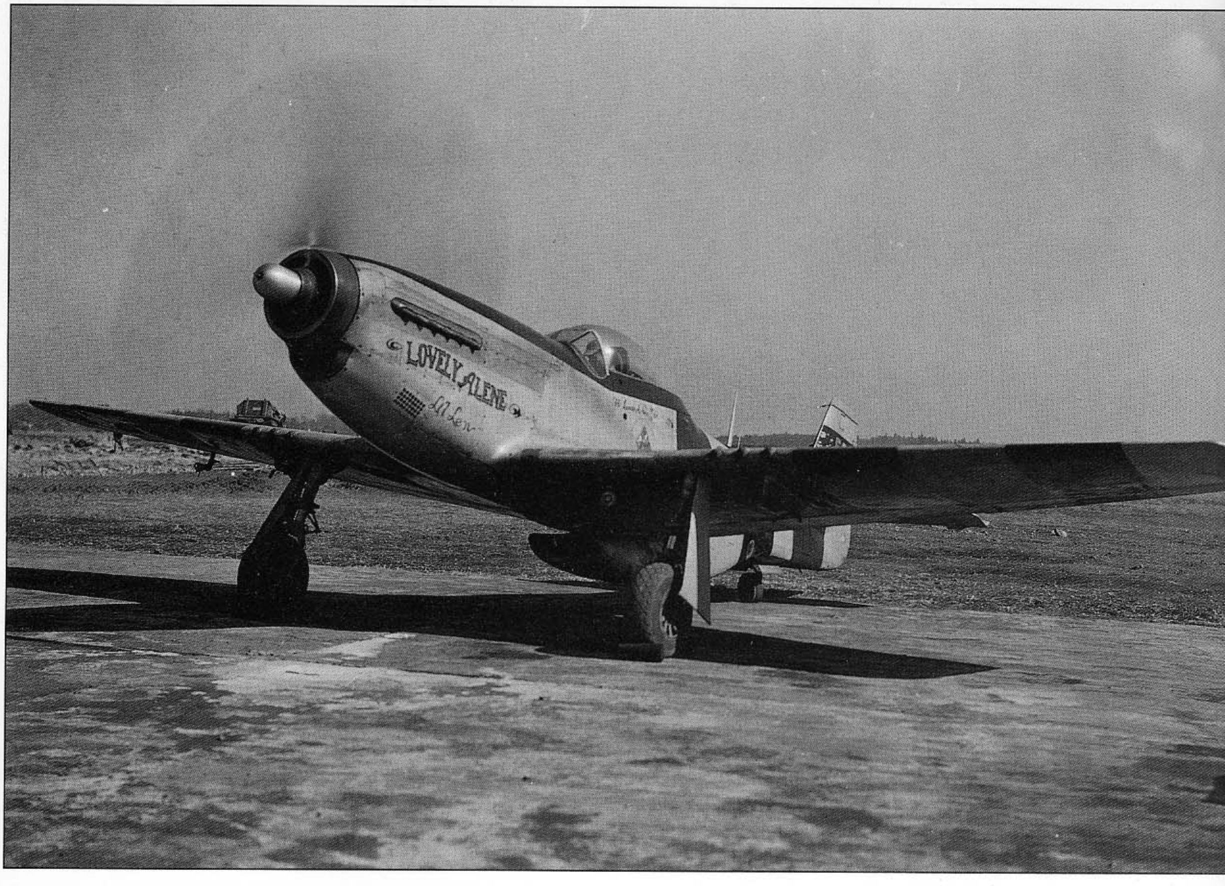
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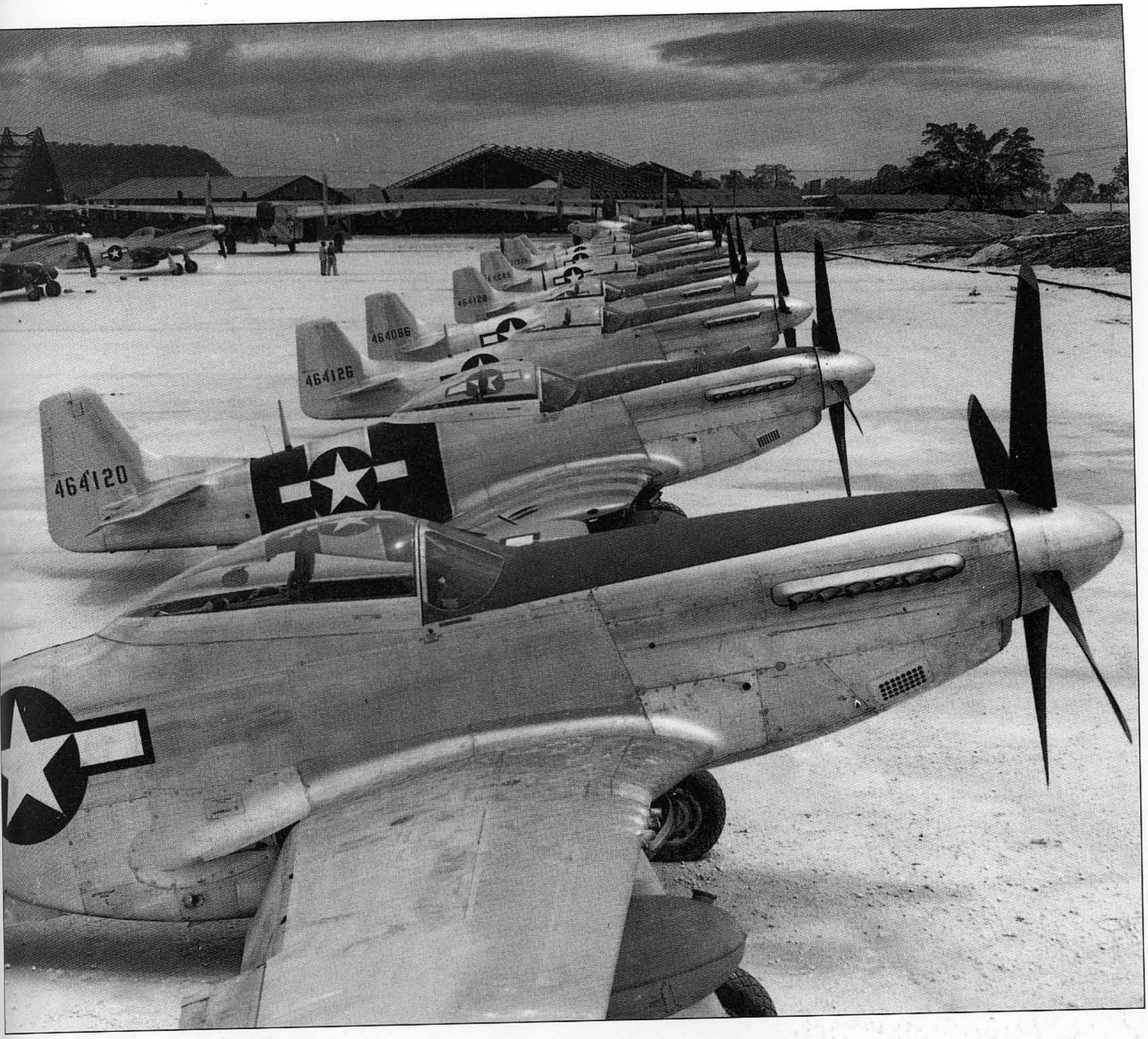


OPPOSITE TOP Col William Banks leads a colourfully appointed pack of Mustangs from the 348th FG. His own aircraft was P-51K-10-NT USAAF s/n 44-12073 *SUNSHINE VII*

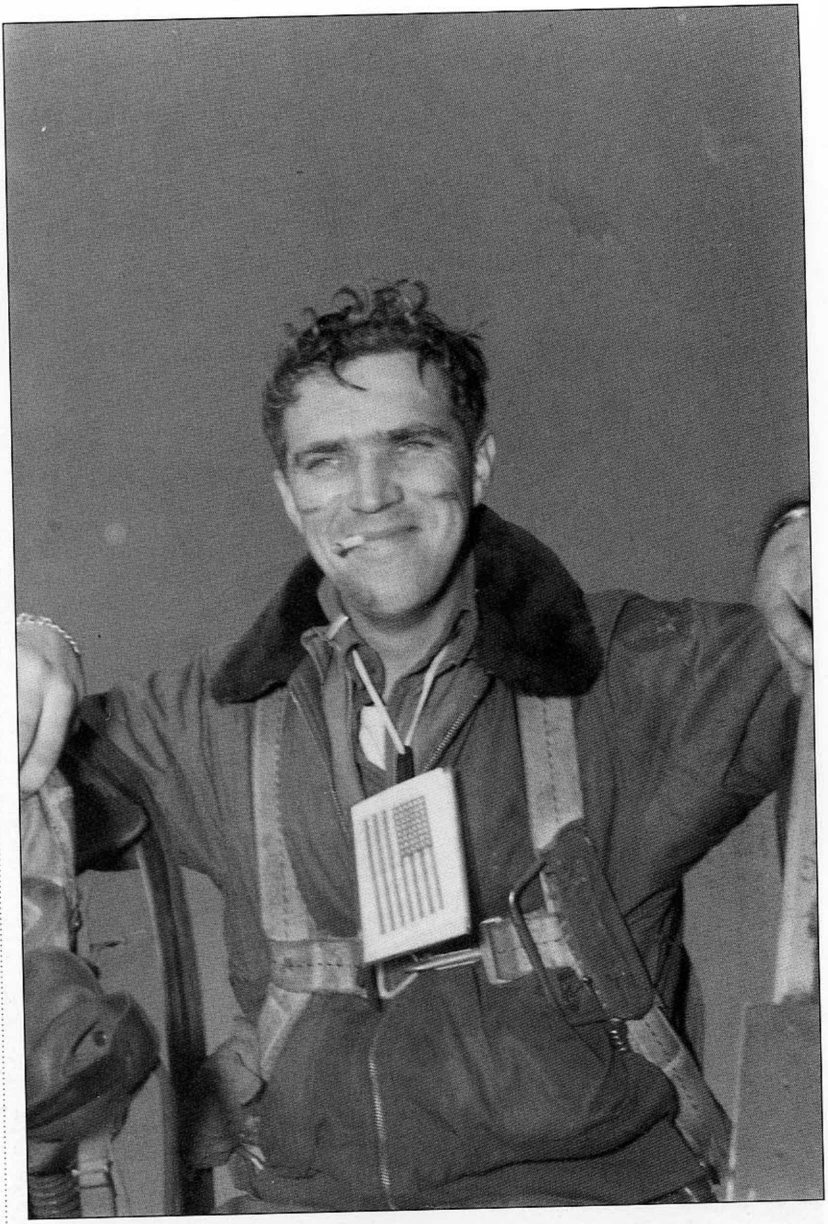
LEFT The Merlin engine of a 3rd AC Mustang is run up prior to maintenance at an occupied Japanese airfield following VJ-Day. As well as the black fuselage bands, the unit's aircraft also carried six black wing bands. Part of the occupation forces, the 3rd AC operated out of Chitose

ABOVE Two days after the atomic bombings, these Mustangs stand neatly parked at their Pacific airstrip – waiting for a mission in a war that had come to a sudden, and startling, conclusion

CHAPTER 7

MUSTANG MEN

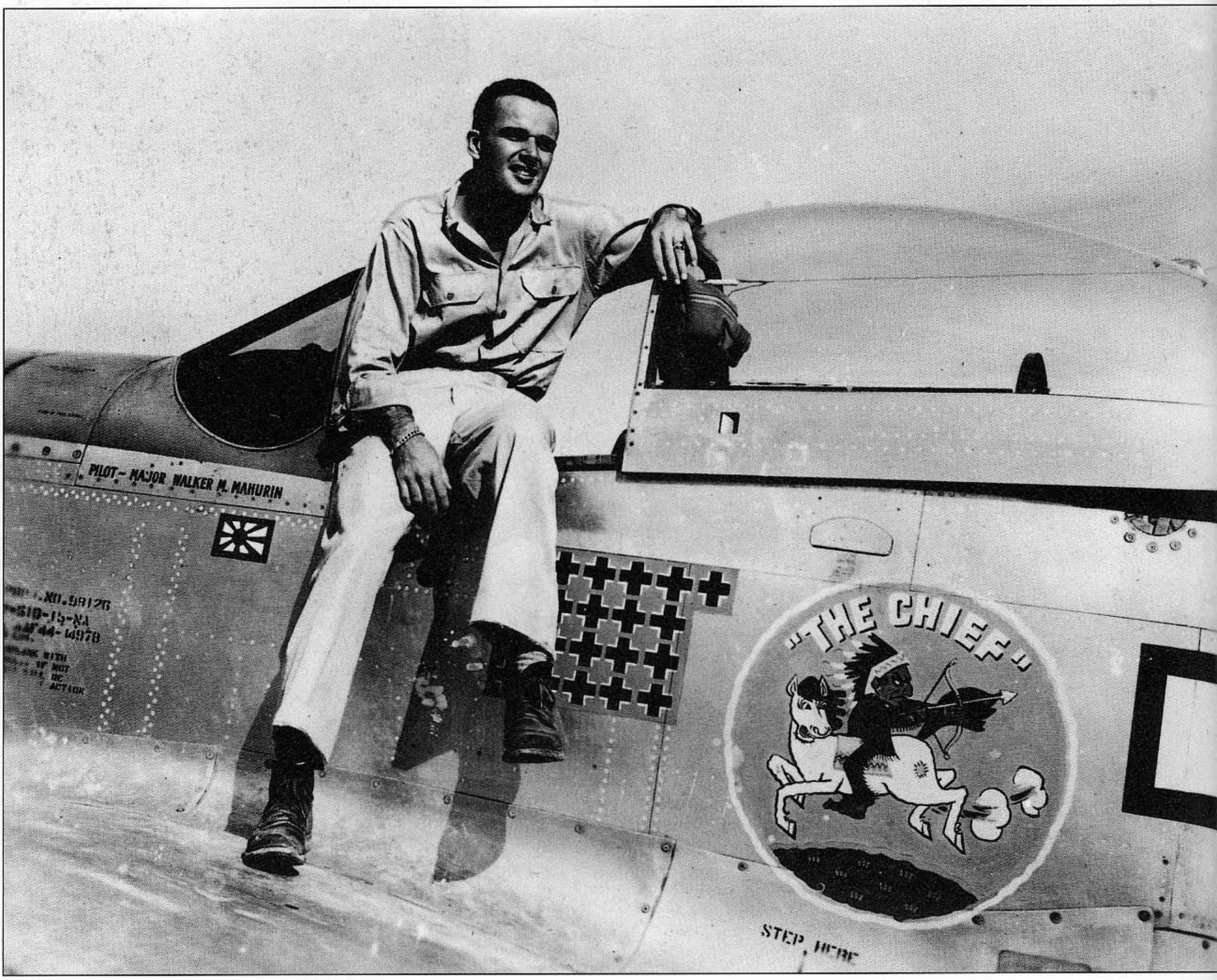
LEFT Maj David L 'Tex' Hill, A-2 jacket firmly buttoned up, prepares for a mission in his 75th FS, 23rd FG P-51B somewhere in China. Hill originally entered the Navy during 1938 and received his flight training at NAS Pensacola, going on to fly with VT-3 aboard the USS *Saratoga* and VS-41 aboard the USS *Ranger*. Resigning his commission during the summer of 1941, Lt(jg) Hill joined the American Volunteer Group (AVG) in China, where he went on to destroy a total of $12^3/4$ Japanese aircraft before it disbanded on 4 July 1942. Hill decided to stay in China, accepting a commission as a major with the USAAF and then going on to activate the 75th FS, where he destroyed four more Japanese fighters. In December 1942 he returned to the USA, but was posted back to China the following year, where he assumed command of the 23rd FG and destroyed two more enemy fighters. Returning to America once again, Hill became CO of the 412th FG with Bell YP-59s (later P-80s) – the USAAF's first jet unit. He separated from the service in 1945 and joined the Texas Air National Guard



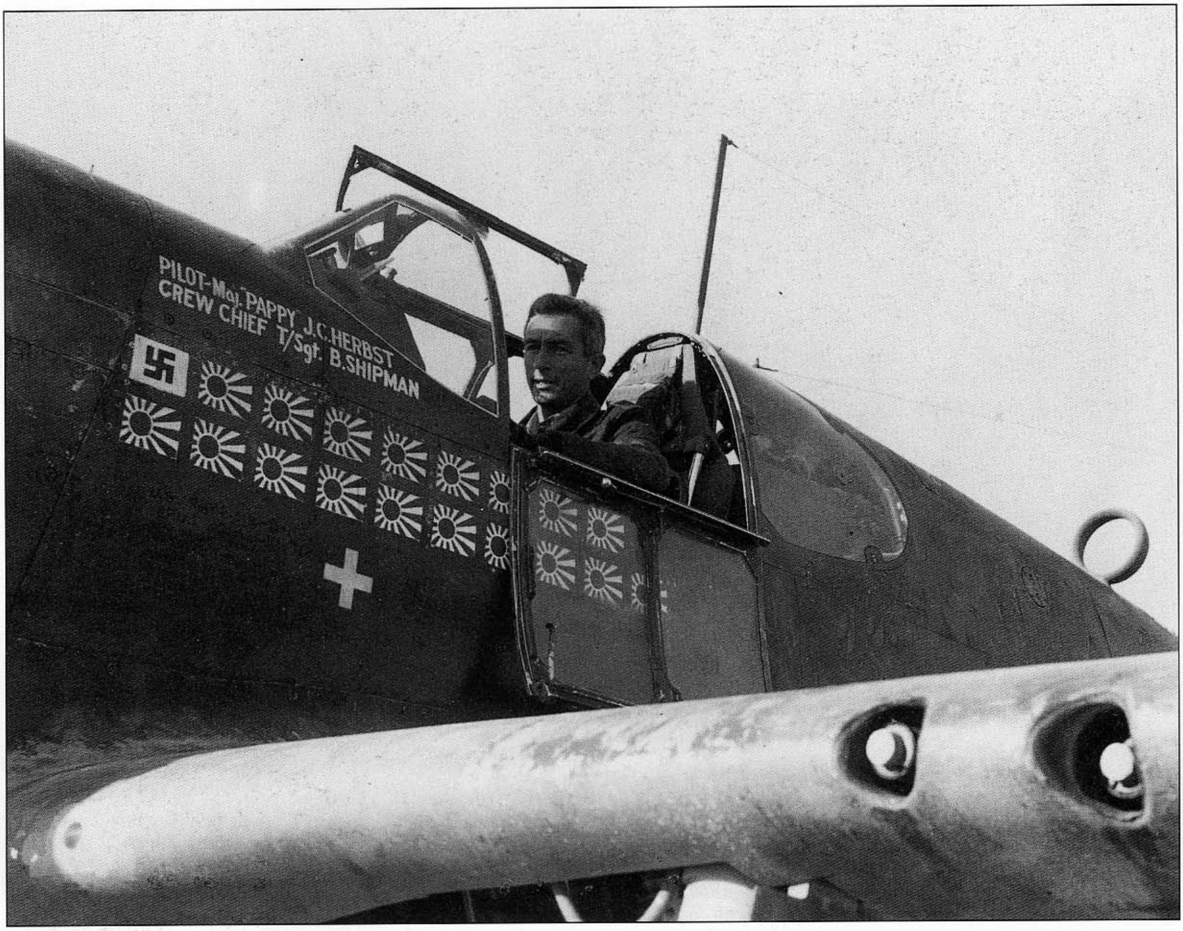
ABOVE His face marred from hours of wearing goggles, a smiling 2nd Lt Robert G Young, Jr. enjoys a smoke in the cockpit of his P-51D after returning from a bomber escort mission to Berlin. The flag placard around his neck identifies the pilot as an Amer-ican, while the reverse side carried an inscription in Russian further confirming his status as an USAAF flyer

BELOW Major Walker M 'Bud' Mahurin, with his elaborately marked P-51D-15-NA USAAF s/n 44-14978 *"THE CHIEF"*, was part of the 3rd FG, 3rd FS, in the Philippines. Mahurin achieved the majority of his aerial victories in Europe while flying Thunderbolts, but on 14 January 1945 he shot down a Japanese 'Dinah' while piloting this aircraft. During the Korean War, he was credited with 3½ MiG 15s destroyed before being shot down and taken prisoner

RIGHT Lt John C 'Whips' Meyer in the cockpit of 487th FS P-51D-15-NA USAAF s/n 44-15041 'HO-M' *Petie 3rd* on 6 January 1945, when he was, with 37½ victories (24 in the air, 13½ on the ground), the top-ranking ace in the Eighth Air Force. Staying in the air force after World War 2, Meyer went on to command the Strategic Air Command before retiring from the USAF as a General on 1 August 1974. He died of a heart attack the following year while jogging on a Los Angeles beach


PILOT – MAJOR WALKER M. MAHURIN
"THE CHIEF"
STEP HERE

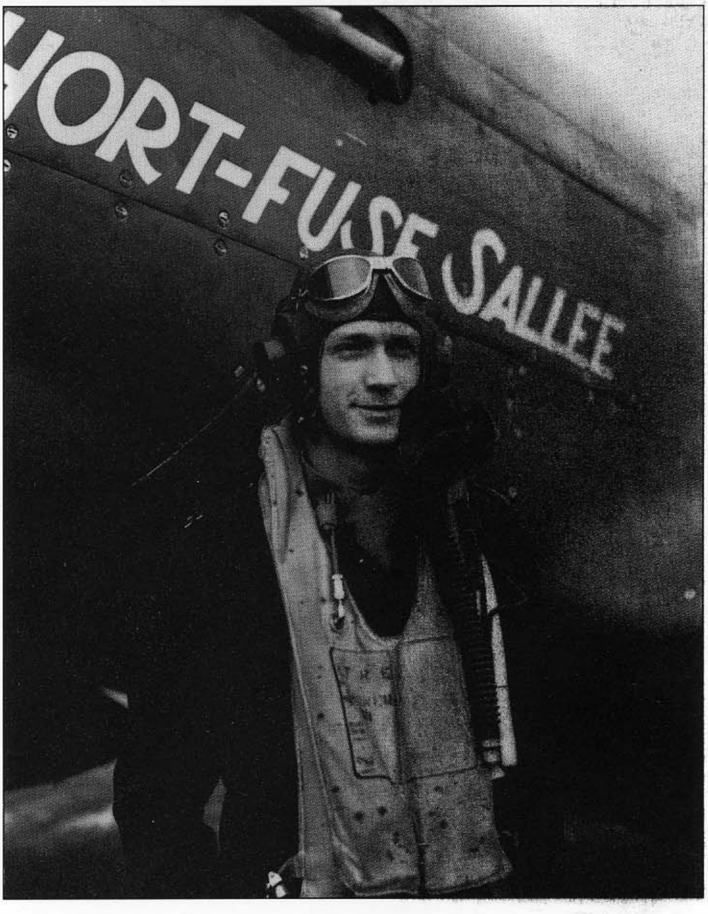
HAND HOLD



ABOVE Maj John Coleman 'Pappy' Herbst in the cockpit of 74th FS, 23rd FG P-51B-7-NA USAAF s/n 43-7060 *Tommy's Dad* in the CBI. The very weathered condition of the Olive Drab and Neutral Grey camouflage is noteworthy, as are the caps placed over the openings for the .50 cal Browning machine guns. Herbst ended the war with 18$^1/_3$ Japanese aircraft destroyed, and like several other American aces, he was killed in a postwar jet crash, perishing in P-80A-1-LO USAAF s/n 44-85053 near San Diego, California. The white cross on the fuselage let groundcrews know that the aircraft was equipped with the fuselage fuel tank

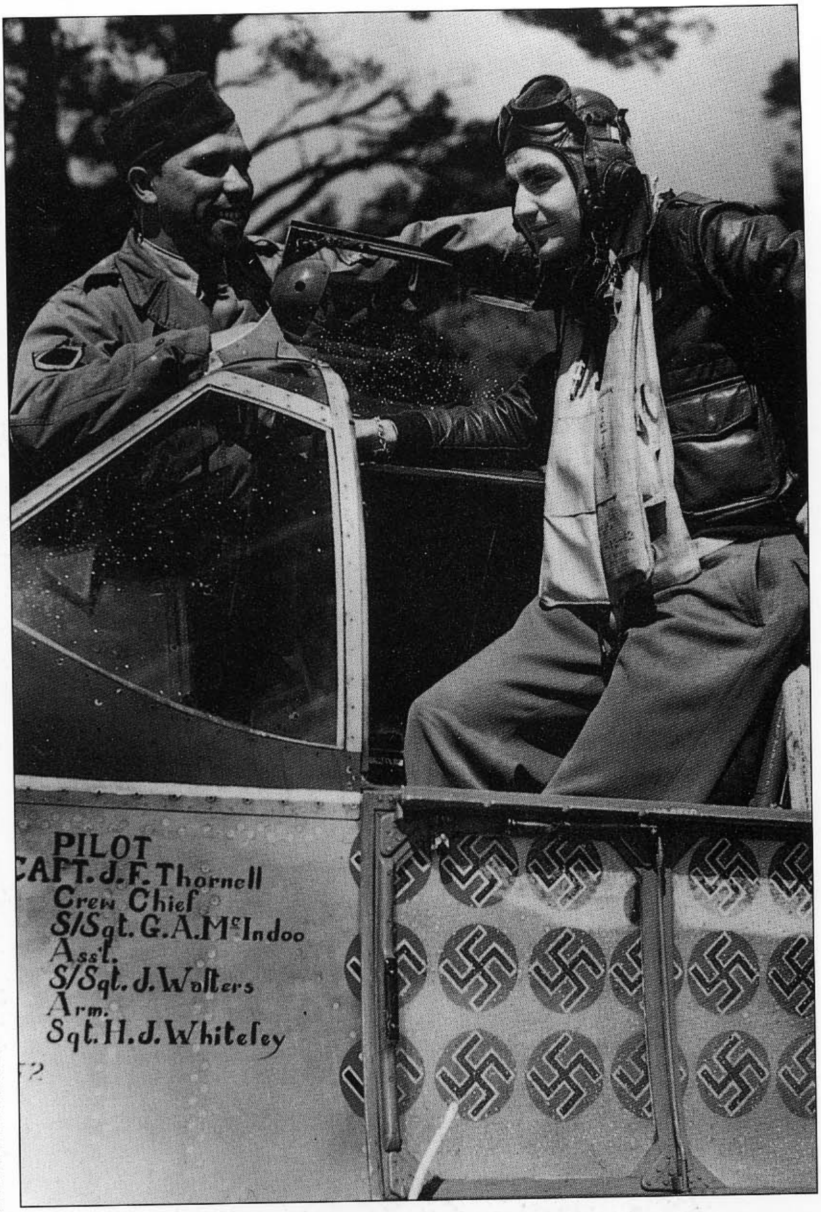
OPPOSITE TOP A rather apprehensive looking Royal Canadian Air Force Mustang I pilot (from probably either Nos 400 or 414 Sqns) waits between missions as ground crewmen remove the F.24 aerial camera. Down low, the Mustang I was an excellent armed photo-recon platform, and Wg Cdr Peter Dudjeen, a former squadron commander of an Army Co-Operation unit, made the following comments on 31 May 1943; 'The long range of this aircraft made it an excellent tactical reconnaissance aircraft and its armament made it effective against most ground targets. As their operations progressed, they swung more and more to offensive reconnaissance and began to take advantage of targets of opportunity until the operation finally developed into a strategic effort against ground objectives such as railway locomotives, canal barges, heavy motor transport vehicles and aircraft on the ground'. The usefulness of the Mustang I was such that less than 100 remained operational with the RAF at the end of the war

RIGHT Maj Richard E Turner with 356th FS P-51B USAAF s/n 43-12434 'AJ-T' *SHORT-FUSE SALLEE.* Turner received his pilot's wings on 29 September 1942 at Luke Field, Arizona, and entered the combat arena with the 20th FG, before being transferred to the 356th FS, 354th FG during January 1943. He destroyed 11 aircraft in combat and damaged eight others, and was also credited with the destruction of two V 1 'buzz bombs'. During the Korean War, Turner flew 13 combat missions with the 4th FIW. He died on 15 November 1986 of complications arising from the onset of Alzheimer's disease



Princess ELIZABETH

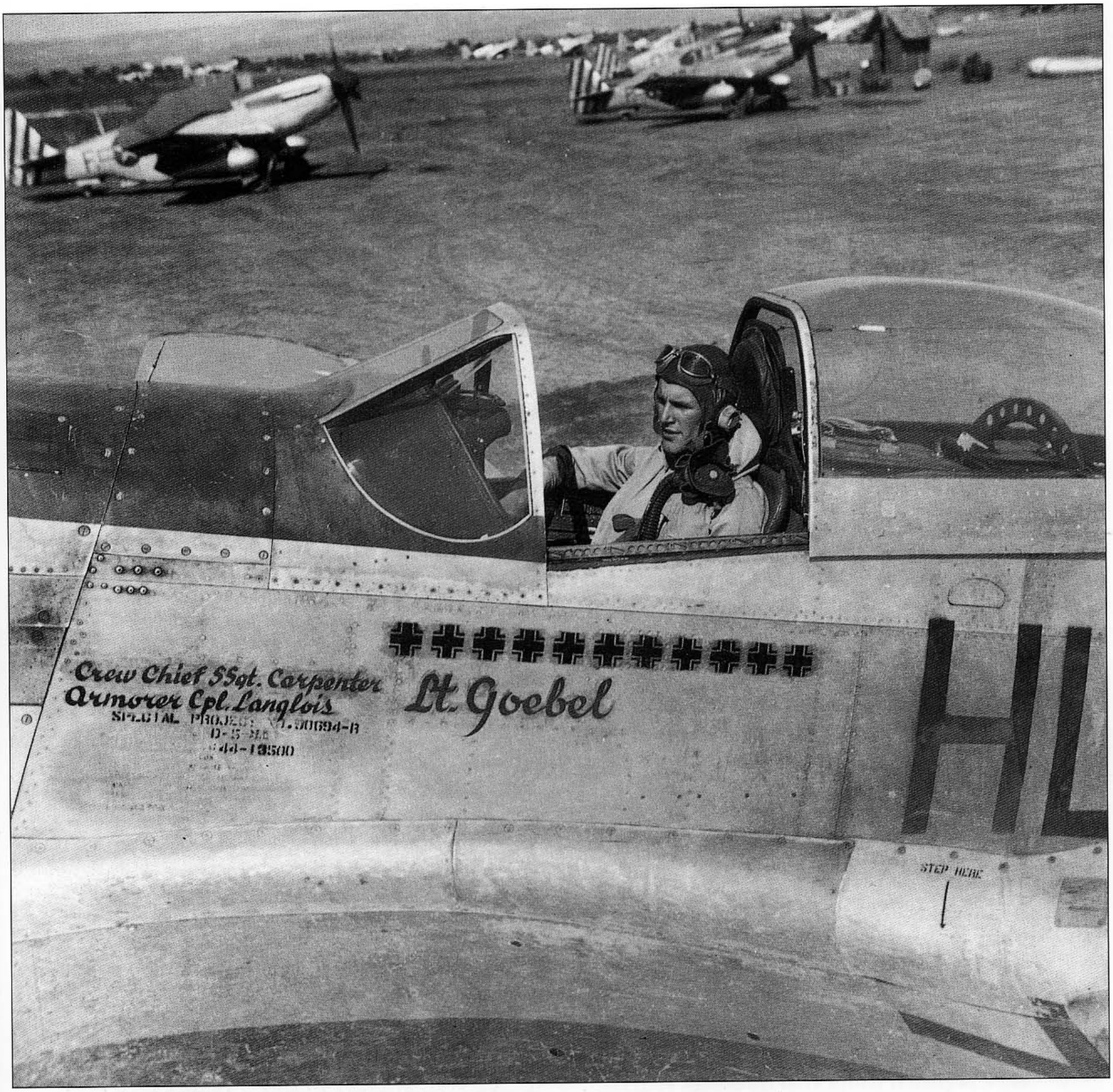
LEFT A displeased looking 1s Lt. William T Whisner is seen with his 487th FS P-51B-5-NA USAAF s/n 42-106449 'HO-W' *Princess ELIZABETH*. Whisner received his wings on 16 February 1943 at Napier Field, Alabama, and was transferred to the 352nd FG a few days later. Achieving his first victory in a P-47D, Whisner was soon flying the Mustang following the transition of his to the NAA fighter. He went on to achieve a total of $15^{1}/_{2}$ victories, all Luftwaffe fighters, and two probables. Whisner also saw combat during the Korean War, shooting down $5^{1}/_{2}$ MiG 15s and damaging six more. The reason for the unhappy look? Whisner's Mustang had been chosen to receive the name *Princess ELIZABETH* to coincide with the real princess's visit to his Bodney base, and the fighter pilot did not like the idea, nor the attendant press publicity. The valiant fighter ace died following an allergic reaction to a yellow jacket sting on 21 July 1989 in Alexandria, Louisiana



LEFT During the D-Day invasions, USAAF and Commonwealth Mustangs racked up countless missions against the enemy. The fact that these aircraft could be rapidly turned around was due to the unwavering dedication of the groundcrews – often working in the open in harsh weather. These RAF personnel are seen 'bombing up' a Mustang III. Note the crudely painted D-Day identification stripes

ABOVE Capt John Francis 'Smiling Jack' Thornell poses with crew chief SSgt G A McIndoo and P-51B-15-NA USAAF s/n 42-106872 'PE-T' of the 328th FS. The pilot used this very aircraft to destroy three Bf 109s on 8 May 1944 near Nienburg. Thornell finished the war with 17.25 aerial victories and two damaged. Note the additional rear view mirror that helped compensate for the B-model's lack of rearward visibility

Charismatic Col Donald James Mathew 'Col Don' Blakeslee in the cockpit of a P-51D Mustang. Blakeslee had a long military career, joining the Army Reserves in 1938, where he served as a 2nd lieutenant in the infantry. Honourably discharged in 1940, he joined the Royal Canadian Air Force and arrived in Britain during May 1941. Blakeslee served with Nos 401 and 133 Sqns flying Spitfire VBs, destroying or damaging 13 Luftwaffe aircraft. He entered the USAAF as a Captain on 29 September 1942, initially flying Thunderbolts. Blakeslee rapidly rose through the ranks because of his natural combat leadership, and he was so impressed with the Mustang that he argued, successfully, that the 4th FG should replace its P-47s with P-51s. His final tally was 14.5 destroyed, three probables and 11 damaged – an impressive record for a high-ranking pilot who had to devote much of his time to administrative duties


Crew Chief SSgt. Carpenter
Armorer Cpl. Langlois
Lt. Goebel
HL
STEP HERE

ABOVE Lt Robert John Goebel in the cockpit of his 308th FS P-51D-5-NA USAAF s/n 44-13300 'HL-D' *Flying Dutchman*. Receiving his wings on 24 May 1943, Goebel went on to fly Airacobras in the Canal Zone, before being transferred to the 31st FG on 1 April 1944. Goebel scored all his victories with the 308th while flying a mixture of Bs and Ds, and he ended the war with 11 confirmed aerial victories and one probable

APPENDICES

MUSTANG VARIANTS

NA-73X

Handbuilt prototype with civil registration NX19998 (c/n 73-3097) for British requirement. Unarmed with highly polished natural metal finish, powered by Allison V-1710-30 of 1150 hp. Heavily damaged on early test flight, rebuilt and flight testing continued. Final fate of this aircraft is uncertain, perhaps scrapped or donated to trade school.

XP-51-NA

USAAF acquired two early production Mk Is (c/n 73-3101 and 73-3107) for testing to see if the aircraft had combat potential for the Army. Had carried RAF serials AG348 and AG354, assigned USAAC serials 41-038 and 41-039. Initially flown in natural metal testing, aircraft went through several paint schemes. Powered by V-1710-39. One survives with EAA Museum.

P-51-NA

Similar to Mk I, 150 built with four 20 mm cannon in wing and with American style instruments, radios and controls replacing British items. Carrying construction numbers 91-11981 through 91-12130, aircraft were given RAF serials FD418 through FD597. 57 were converted to P-51-1-NA standards (later F-6A-NA) and carried two K.24 cameras (serials 41-37320 through 41-37339; 41-37352 through 41-37366; 41-37368 through 41-37371; 41-37412 through 41-37429. One aircraft (41-37426/ FD524) was transferred to US Navy as BuNo 57987. Most aircraft were delivered in RAF style camouflage or US Olive Drab/Neutral Grey.

P-51A-NA

Similar to P-51-NA but wing cannon replaced with four .50 cal Brownings. Allison V-1710-81/1200 hp. Two underwing pylons for bombs or drop tanks. 50 transferred to RAF to replace aircraft kept by Army for P-51-1-NA conversion, and 35 later converted to F-6B-NA. Production stopped at P-51A-10 in order to change line over to Merlin power.

A-36A-NA

P-51A optimised for ground attack. Aircraft retained machine gun armament but had dive brakes mounted above and below wing. Allison V-1710/1325 hp. Underwing racks could carry 500-lb bombs. Delivered in Olive Drab and Neutral Grey camouflage.

XP-51B-NA

Two P-51-NAs (41-37352, 41-37421) rebuilt with Merlin V-1650-3/1380 hp engines. Many other detail modifications made to areas such as radiator, cowling and ailerons. Originally redesignated XP-78-NA before switching to XP-51B. Olive Drab/Neutral Grey camouflage.

P-51B-NA

Total of 1988 B-models constructed, of which 71 B-10-NA were converted to F-6C-NAs. Early version powered with V-1650-3/1380 hp. Four Browning machine guns in wing. Later versions had V1650-7. 550 B-5s became B-7s with addition of fuselage fuel tank. Underwing racks held drop tanks, bombs. Fuselage tank retrofitted to earlier aircraft. Delivered in Olive Drab/Neutral Grey until AAF edict eliminated camouflage.

P-51C-NT

Basically identical to B except for the fact that it was built at the Dallas, Texas, plant. Total of 1750 Cs completed, including 20 converted to F-6C-NT. C-1 powered with V-1650-3, but remaining 1400 aircraft carried more powerful -7.

XP-51D-NA

Conversion of two P-51B-10s (42-106539, 42-106540) with cut-down rear fuselage and bubble canopy. Many detail refinements. Olive Drab/Neutral Grey.

P-51D-NA

Production bubble top Mustang. Four P-51D-1-NAs completed with original built-up canopy. Total of 6502 Ds built at Inglewood. Dorsal fin added after production commenced to compensate for loss of keel surface after removal of top rear fuselage. 1454 P-51D-NT built at Dallas. Many refinement modifications introduced throughout production. D-24-NA had two sets of rocket stub launchers under each wing panel. Six .50 cal Browning guns. Dallas delivered 135 F-6D-20-NT/-25-NT tac-recon variants. Most delivered in natural metal finish.

TP-51D

Ten Ds modified for dual control training and extensive work carried out in the cockpit area for provision of a second seat and full instrument panel. Part of rear fuselage cut away to make more room for second seat (first conversion used standard cockpit space and regular canopy) and a larger, longer canopy was fitted. After the war, further TPs (designated TF by this time) were built from random airframes by Temco in Dallas.

P-51E

Original designation for Dallas-built D but dropped in favour of D-NT.

XP-51B

Two built with 1675 hp Rolls-Royce RM.14.SM Merlin (c/n 105-25931 to -25932) with five-blade Rotol propellers which gave unstable flight characteristics. One to RAF.

P-51K-NT

Same as P-51D-NT but built with Aeroproducts propeller instead of Hamilton Standard unit. Total of 1500 Ks built, including 163 as F-6K-NTs; 594 transferred to RAF as Mustang IV. With the K-10-NT, underwing rocket stubs for four 5 in rockets added.

P-51M-NT

Dallas-built version of the P-51D-30-NT with V-1650-9A engine. One completed but remaining order for 1628 cancelled with end of war.

ROYAL AIR FORCE MUSTANG VARIANTS

Mk I

620 built, ten transferred to Soviets, two to the USAAF. Allison V-1710-39/1150 hp. Four .50 cal guns in wing, two .30 cal guns in lower nose.

Mk IA

Same as Mk I but with four 20 mm cannon in wing. Part of order kept by USAAF.

Mk II

50 aircraft similar to P-51A.

Mk III

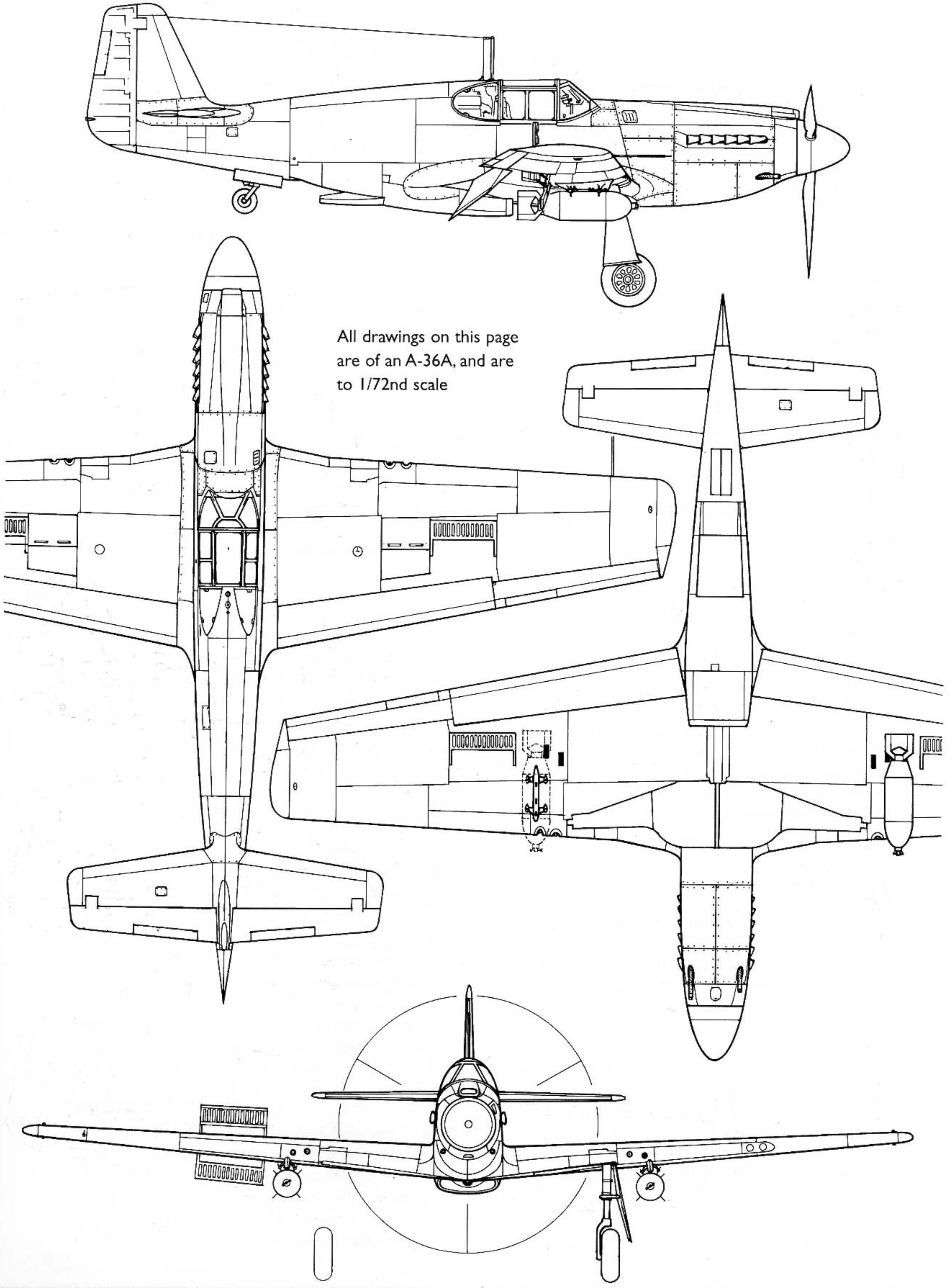
852 aircraft, some transferred to RAAF and USAAF. Similar to P-51B/C.

Mk IV/IVA

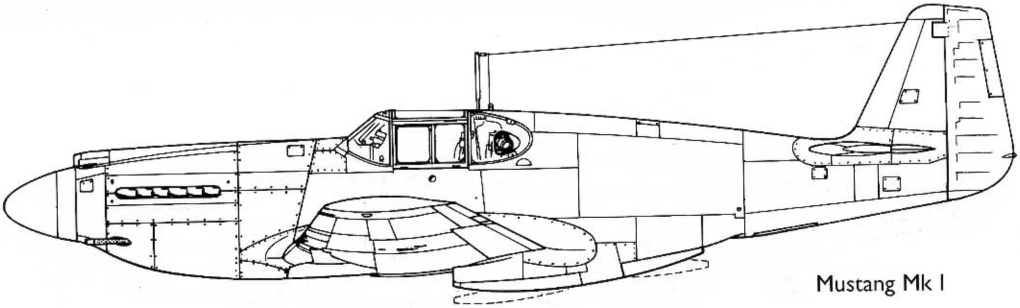
Similar to P-51D/K.

Mk X

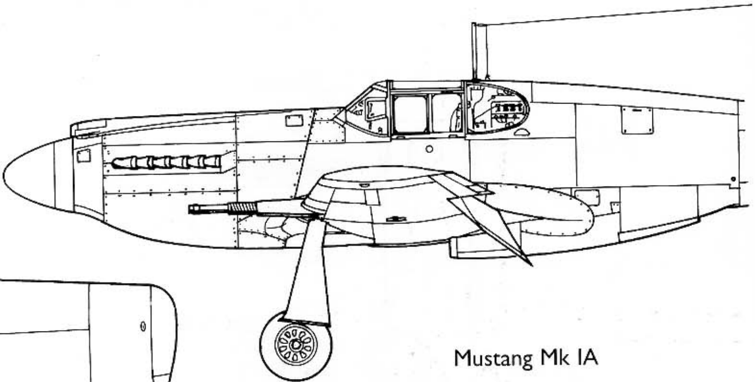
Four Mk Is (AL963, AL975, AM203, AM208) converted with Rolls-Royce Merlin 61 or 65 engines with four-blade props, different radiators, etc for testing.



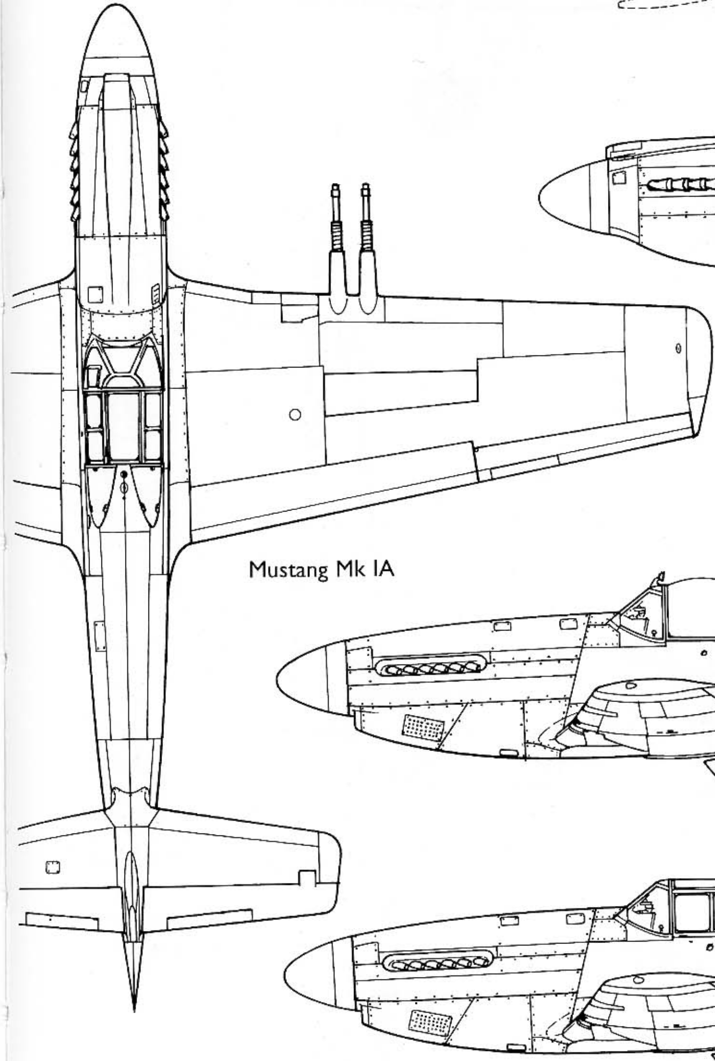
All drawings on this page are of an A-36A, and are to 1/72nd scale



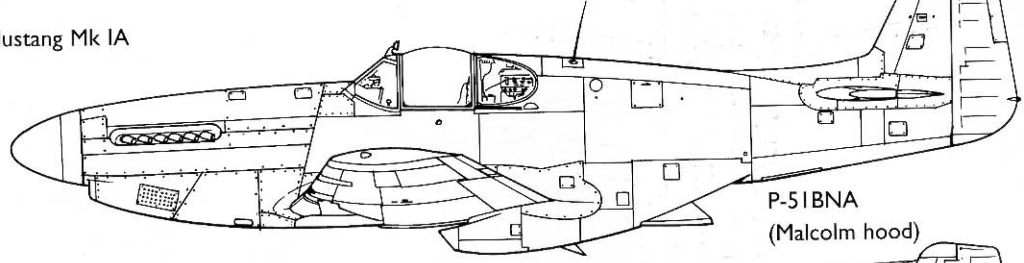
Mustang Mk I



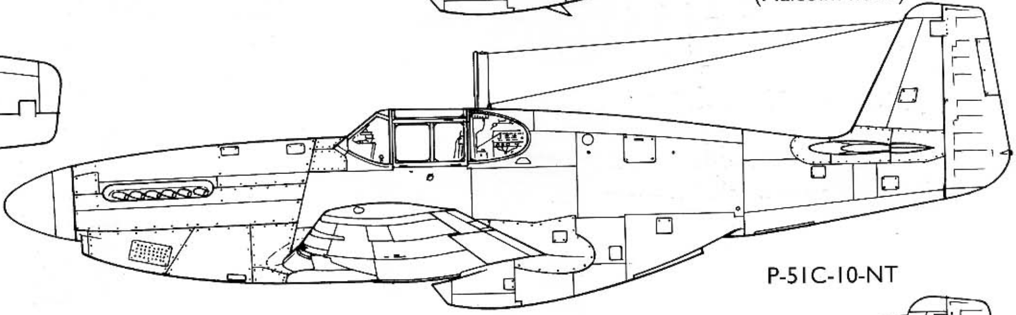
Mustang Mk IA



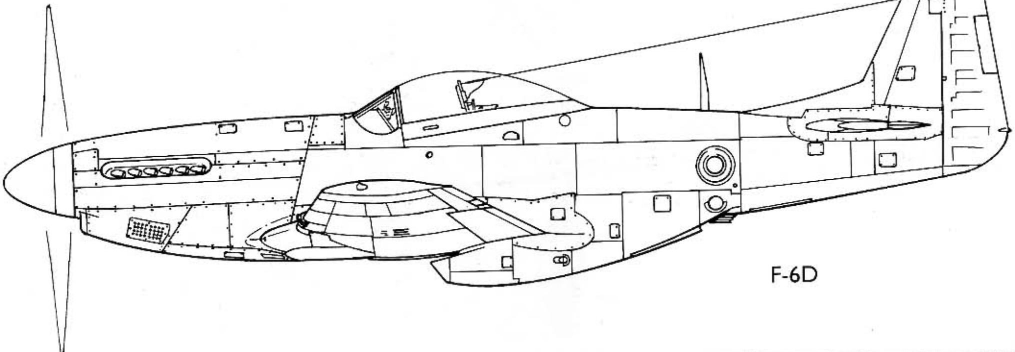
Mustang Mk IA



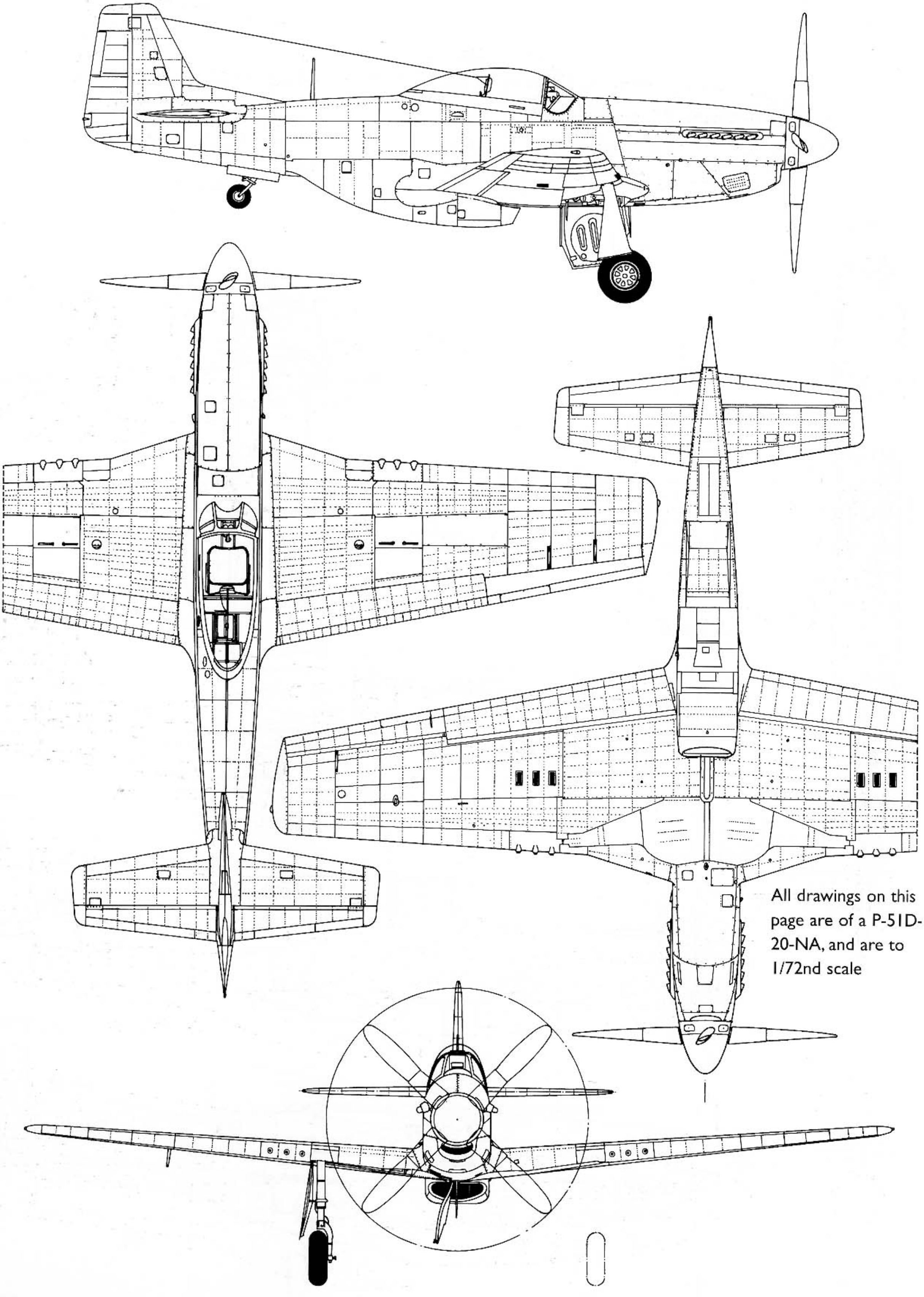
P-51BNA
(Malcolm hood)



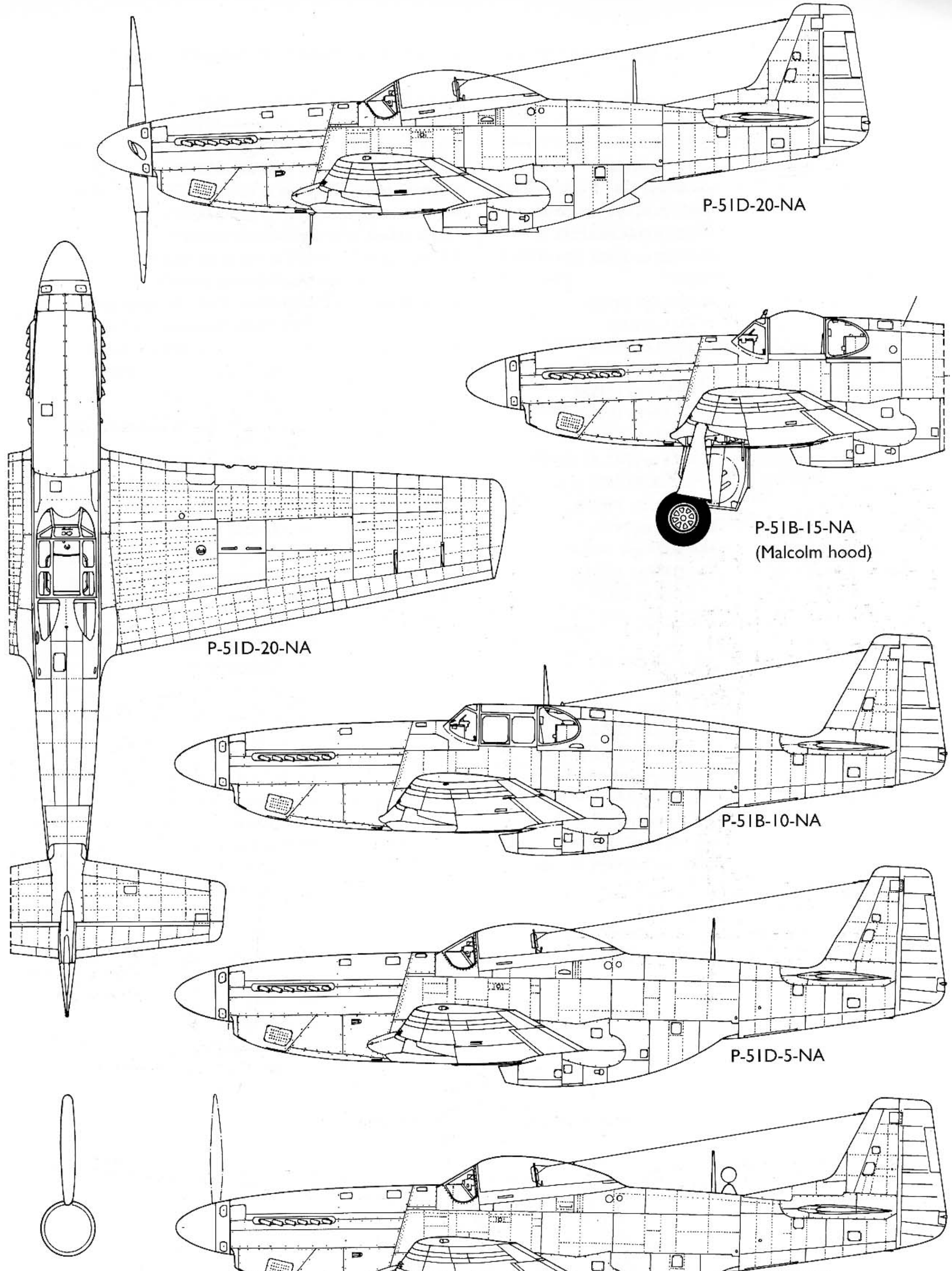
P-51C-10-NT



F-6D



All drawings on this page are of a P-51D-20-NA, and are to 1/72nd scale


P-51D-20-NA
P-51B-15-NA
(Malcolm hood)
P-51D-20-NA
P-51B-10-NA
P-51D-5-NA
P-51K-5-NT

NAA MUSTANG MODEL DESIGNATIONS

NAA	***Designation***	***Military Serials***
NA-73X	NA-73X	none (civil NX19998)
NA-73	Mustang I	AG345 to AG664
RD-1058	XP-51	41-038 and 039
NA-83	Mustang I	AL958 to AL999, AM100 to AM257, AP164 to AP263
NA-91	P-51	41-37320 to 37469, FD418 to FD587
NA-97	A-36A	42-83663 to 84162
NA-99	P-51A	43-6003 to 6312
NA-101	XP-51B	41-37352 to 37421
NA-102	P-51B-1	43-12093 to 12492
NA-103	P-51C-1, -5 and -10	42-102979 to 103378, 42-103379 to 103978, 43-24902 to 25251
NA-104	P-51B-5, -10 and -15	43-6713 to 7202, 42-106429 to 106538, 43-6313 to 6712, 42-106541 to 106978, 43-24752 to 24901
NA-106	P-51D	42-106539 and 106540
NA-107	P-51D	42-103379 to 103978, 43-24902 to 25251
NA-109	P-51D-5, -10 and -15	44-13253 to 1575
NA-110	P-51D-1	? (disassembled to Australia)
NA-111	P-51C-10,	44-10753 to 11152
	P-51D-5	44-11153 to 11352
	P-51K	44-11353 to 12852
	P-51D-20	44-12853 to 13252
NA-112	P-51D	cancelled, transferred to NA-109
NA-122	P-51D	44-63160 to 64159, 44-72027 to 72126, 44-72127 to 73626, 44-73627 to 75026
NA-124	P-51D	44-84390 to 84989, 45-11343 to 75025
	P-51M	45-75026
NA-127	P-51D	cancelled, transferred to NA 26
NA-138	P-51D	cancelled, end of war

MUSTANG SERIAL NUMBERS

XP-51-NA	41-038 and -039
P-51-NA	41-37320 to -37469
P-51A-1-NA	43-6003 to -6102
P-51A-5-NA	43-6103 to -6157
P-51A-10-NA	43-6158 to -6312
XP-51B-NA	41-37352, 41-37421
P-51B-1-NA	43-12093 to -12492
P-51B-5-NA	43-6313 to -6352; 43-6353 to -6752; 43-6753 to -7112
P-51B-10-NA	43-7113 to -7202; 42-106429 to -106538; 42-106541 to -106738
P-51B-15-NA	42-106739 to -106908; 42-106909 to -106978; 43-24752 to -24901
P-51C-1-NT	42-102979 to -103328
P-51C-5-NT	42-103329 to -103378; 42-103379 to -103778
P-51C-10-NT	42-103779 to -103978; 43-24902 to 25251; 44-10753 to -10782
P-51C-11-NT	44-10783 to -10817
P-51C-10-NT	44-10818 to -10852
P-51C-11-NT	44-10853 to -10858
P-51C-10-NT	44-10859 to -11036
P-51C-11-NT	44-11037 to -11122
P-51C-10-NT	44-11123 to -11152
XP-51D-NA	42-106539, 42-106540
P-51D-5-NA	44-13253 to -14052
P-51D-10-NA	44-14053 to -14852
P-51D-15-NA	44-14853 to -15252; 44-15253 to -15752
P-51D-20-NA	44-63160 to -64159; 44-72027 to -72126; 44-72127 to -72626
P-51D-25-NA	44-72627 to -73626; 44-73627 to -74226
P-51D-30-NA	44-74227 to -75026
P-51D-5-NT	44-11153 to -11352
P-51D-20-NT	44-12853 to -13252
P-51D-25-NT	44-84390 to -84989; 45-11343 to -11542
TP-51D	45-11443, 45-11450; 44-84610 to -84611
P-51K-1-NT	44-11353 to -11552
P-51K-5-NT	44-11553 to -11952
P-51K-10-NT	44-11953 to -12752; 44-12753 to -12852
P-51L-NT	44-91104 to -92003 (cancelled)
P-51M-NT	45-11743

ROYAL AIR FORCE MUSTANG SERIALS

Mk I	AG345 to AG663; AG664; AL958 to AM257; AP164 to AP263
Mk IA	FD418 to FD567
Mk II	FR890 to FR939
Mk III	FB110 to FB399; FR411; FX848 to FX999; FZ100 to FZ197; HB821 to HB961; HK944 to HK947; HK955 to HK956; KH421 to KH640; SR406 to SR440
Mk IV	KH641 to KH670
Mk IVA	KH671 to KH870; KM100 to KM492; TK586; TK589; KM744 to KM799 (cancelled)

MUSTANG SPECIFICATIONS

XP-51

Span	37 ft
Length	32 ft 3 in
Height	12 ft 2 in
Wing area	233 sq ft
Empty weight	6280 lb
Loaded weight	8400 lb
Max speed	382 mph
Cruise speed	300 mph
Ceiling	30,800 ft
Climb	2500 fpm (initial)
Range	625 to 1040 miles
Powerplant	Allison V-1710-39/1150 hp

P-51

Overall dimensions	as XP-51
Empty weight	6550 lb
Loaded weight	8800 lb
Max speed	387 mph
Cruise speed	307 mph
Ceiling	31,300 ft
Climb	2200 fpm (initial)
Range	350 to 1175 miles
Powerplant	Allison V-1710-39/1150 hp

P-51A

Overall dimensions	as XP-51
Empty weight	6430 lb
Loaded weight	9000 lb
Max speed	390 mph
Cruise speed	305 mph
Ceiling	31,400 ft
Climb	2300 fpm (initial)
Range	350 to 2550 miles
Powerplant	Allison V-1710-81/1200 hp

XP-51B

Span	37 ft
Length	32 ft 3 in
Height	13 ft 8 in
Wing area	233 sq ft
Empty weight	7050 lb
Loaded weight	8880 lb
Max speed	441 mph
Ceiling	42,000 ft
Climb	3600 fpm (initial)
Powerplant	Packard V-1650-3/1380 hp

P-51B

Overall dimensions	as XP-51B
Empty weight	6980 lb
Loaded weight	11,800 lb
Max speed	439 mph
Cruise speed	362 mph
Ceiling	41,500 ft
Climb	30,000 ft in 12.1 minutes
Range	400 to 2700 miles
Powerplant	Packard V-1650-7/1490 hp

P-51D

Overall dimensions	as XP-51B
Empty weight	7100 lb
Loaded weight	11,600 lb
Max speed	437 mph
Cruise speed	362 mph
Ceiling	41,900 ft
Climb	30,000 ft in 13 minutes
Range	up to 2800 miles
Powerplant	Packard V-1650-7/1490 hp

EIGHTH, NINTH & FIFTEENTH AIR FORCE MUSTANG CODES

AJ	356th FS/354th FG
AX	107th TRS/67th TRG
CG	38th FS/55th FG
CL	338th FS/55th FG
CV	368th FS/359th FG
CS	370th FS/359th FG
CY	343rd FS/55th FG
FT	353rd FS/354th FG
GQ	355th FS/354th FG
HL	83rd FS/78th FG
HL	308th FS/31st FG
HO	487th FS/352nd FG
IV	369th FS/359th FG
IX	162nd TRS/10th PRG
JA	65th FW
KI	55th FS/20th FG
LC	77th FS/20th FG
LH	350th FS/353rd FG
MC	79th FS/20th FG
MX	82nd FS/78th FG
MX	307th FS/31st FG
OC	359th FS/356th FG
OS	357th FS/355th FG
PE	328th FS/352nd FG
PI	360th FS/356th FG
PZ	486th FS/352nd FG
QI	361st FS/356th FG
QL	22nd TRS/69th TRG
QP	334th FS/4th FG
QP	2nd FS/52nd FG
SX	352nd FS/353rd FG
VF	336th FS/353rd FG
VF	5th FS/52nd FG
VQ	8th ATS
VX	109th TRS/67th TRG
WD	335th FS/4th FG
WD	4th FS/52nd FG
WR	354th FS/355th FG
WZ	84th FS/78th FG
WZ	309th FS/31st FG
YC	10th TRS/69th TRG
YF	358th FS/355th FG
YJ	351st FS/353rd FG
ZM	12th TRS/67th TRG/ 10th PRG
A9	380th FS/363rd FG
A9	160th TRS/363rd TRG
B3	381st FS/363rd FG
B3	161st TRS/363rd TRG
B6	363rd FS/357th FG
B7	374th FS/361st FG
C3	382nd FS/363rd FG
C3	162nd TRS/363rd TRG
C5	364th FS/357th FG
C7	555th FS/496th FTG
D7	503rd FS/339th FG
E2	375th FS/361st FG
E6	402nd FS/370th FG
E9	376th FS/361st FG
G4	362nd FS/357th FG
J2	435th FS/479th FG
L2	434th FS/479th FG
N2	383rd FS/364th FG
N5	111th TRS/69th TRG
R4	36th BS
5E	385th FS/364th FG
5M	15th TRS/67th TRG/ 10th PRG
5Q	504th FS/339th FG
5Y	384th FS/364th FG
6N	505th FS/339th FG
7F	485th FS/370th FG
9B	436th FS/479th FG
9D	401st FS/370th FG
9H	857th BS

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Undoubtedly the finest US fighter of World War 2, the Mustang was built in astonishing numbers – 7956 P-51Ds alone – as the might of America's industrial base swung into line in support of the nation's global war effort. This new series follows the great fighting types of the conflict from the raw metal phase, through construction and testing, to the combat theatres of Europe, the Middle East, China/Burma/India and the Pacific. Using the best official and private archival black and white and colour material available, all facets of the Mustang's construction are revealed.

EACH VOLUME IN THE PRODUCTION LINE TO FRONTLINE SERIES CONTAINS:

* the best archival black and whites available

* detailed text and captions outlining the history of the aircraft, plus the production techniques used in its construction

* the ultimate photographic references for the hobbyist, showing aircraft (and pilots) of the period, rather than restored warbirds of the 1990s

* scale drawings of all the major P-51 variants featured

* detailed appendices outlining production batches

* period colour advertisement gallery

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